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CONTENTS

IMPROVING THE FISHERIES CONTRIBUTION TO WORLD FOOD SUPPLIES 159

CATCH OF FISH, CRUSTACEANS AND MOLLUSKS BY SPECIES GROUPS IN 18 COUNTRIES, 1938 AND 1947-52 193

FISH MARKETING IN EAST PAKISTAN 197

NEW FISH HARBOR PLANNED FOR KARACHI, PAKISTAN 200

MARINE FISHERIES RESOURCES OF CHILE 201

REPORT ON THE FISH CANNING INDUSTRY IN YUGOSLAVIA 204

SURVEY OF THE SPONGE FISHERIES OF LIBYA 205

CONFERENCES AND MEETINGS 207

NOTES ON PUBLICATIONS 209

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Figure 1. Chilean trawler fishermen emptying a bag of hake on the deck.

MPROVING THE FISHERIES CONTRIBUTION TO WORLD FOOD SUPPLIES*

ntroduction

There has probably never been a time when man was more clearly ware than he is today of the deficiencies in his food supplies, nor more specially, of the need for prompt and effective action to initiate, vithin the world's economies, movements which would bring about permanent improvements in these supplies. Great activities are being developed for the expansion and improvement of food industries. Resources re being surveyed and measured, technologies are being improved and ransplanted, industries are being reorganized, manpower trained, capital mobilized and equipment produced in great quantities. Governments are now taking stocks of their problems and measuring tasks vhich must be undertaken in order to hasten the changes which economists and nutritionists, after long study, have determined to be necessary. In such a situation, which demands an objective appraisal of the potentialities of the different food industries, fisheries occupy perhaps an unique position.

Of the world's food supplies only about 10% of its animal protein derives from the waters (1) although these occupy 75% or more of its surface. This directs attention upon the question of whether the seas, lakes and rivers could yield much greater quantities of food and whether it would be possible to secure an increase in fish production proportionately much greater than can be expected from land industries.

It can certainly be said with confidence that the production of foodstuffs and raw material from the world's waters can be greatly increased : the Sixth Session of the FAO Conference expressed the view that world fish production could be doubled without any detriment to the resources (2). The essential questions to be answered now are at what rate can the necessary changes take place, and how could they be achieved ?

In order to clarify ideas of what might reasonably be expected of the fishery industries, and to measure the changes which might appear possible, the 1960 targets of fish for human consumption set out in the FAO *Second World Food Survey* (3) may be compared with the prewar and the most recent figures. The following is a regional summary, prepared from more detailed consumption targets.

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* Prepared by the staff of the Fisheries Division.
(1) Numbers refer to references in the Bibliography, pp. 189-192.

TABLE 1 - FISH PRODUCTION FOR HUMAN CONSUMPTION
(Landed Weight Basis)

Region	Prewar Level	Present Level (1950-52)	1960 Target	1960 Tar % Increa over Pres Output
	..... *Thousand metric tons**			
Far East	8 120	7 860	13 180	6
Near East	310	340	510	5
Africa	250	360	630	7
Latin America	520	780	980	2
Europe	4 490	5 370	5 980	1
North America and Oceania	790	900	1 060	1
U.S.S.R.	...	1 400	2 700	9
World Total	...	**17 000**	**25 000**	4

Source : FAO *Second World Food Survey*, Rome, Italy, 1952.

Note : These figures do not include some 2,000,000 tons of whales which were consider with meat in the *Second World Food Survey*. They also exclude a number of countr for which no figures or estimates were available at the time of printing.

*Throughout this paper the term "ton" means " metric ton ".

When comparing these targets with total world catches in 19 (the year in which the *Second World Food Survey* was made) one mu bear in mind that :

(*a*) the computation is in terms of round fresh weight or lande weight, not of actually consumable flesh, and

(*b*) only a proportion of the total catch, albeit a large shar is used directly for human food.

The following tabulation, based on the latest available infor mation for virtually all countries, shows the significance of thes points :

	1950	1960
	(*Thousand metric tons*)	
Round fresh weight of total catch	25 000	34 000
Landed weight of total catch	21 500	29 000
Landed weight for human food	18 500	27 500
Round fresh weight for human food	21 000	30 000

Note : These figures differ from those in Table 1 for reasons explained in the text an footnote.

Fish are often landed in a gutted and/or headless condition ; sta tistics of such landings, therefore, must be converted, by appropriat factors, to the round fresh weight of the fish when caught. Similarly the weight of the quantities used for human food is less than th total weight, landed or round, by the amounts which are used fo meals, fertilizers and other purposes.

Fish meal production has increased considerably since 1950, an if the present levels should be maintained the catch target for 196 would have to be increased by 1.5 million tons. Correspondingly, an diversion of these supplies to human food purposes may be reflecte in somewhat lower 1960 catch targets. Similarly, the targets do no take into account improvements of nutritional standards which coul be achieved by changes in the pattern of utilization and internationa trade.

Finally, the targets should be studied with reference to the statement on page 21 of the Survey (3) :

> " The targets, as has been said, are a compromise between what may be desirable from the standpoint of nutrition and what may be feasible in practice. They are not ideal nutritional goals for 1960, but rather indicate the general direction along which improvement should move. In establishing them account was taken of the present world food situation and of the potentialities for increased food production in different countries and regions. "

On the most moderate view it is clear that the task for the fishery industries is great : this paper seeks to indicate something of the pattern of evolution and development which might be displayed by these industries within the next few decades, and chiefly, it is devoted to an examination of the main problems which must be faced if substantial rise in fish production is to occur, to meet targets such as those set for 1960.

1. The Growth of the Fisheries

1.1 *Present Production and Utilization*

Although the total annual production from world fisheries cannot yet be accurately measured, FAO estimates (4) that it was about 26 million tons round fresh weight per annum during 1950/52 (Table 2). About 80% was produced from marine waters and the remaining 20% derived from inland waters.

Figure 2 shows the areas where the world's fish supplies originate. It makes clear that there are very great differences between the yields from different areas and that the biggest yields occur mainly in waters more or less adjacent to the land masses of the Northern Hemisphere.

The utilization of these catches (Table 2) differs from area to area in accordance with the composition of the catches, the nature of the demand and the technical capacity to diversify or preserve fisheries products. What is common to all regions is that the greatest single usage of fish is in its fresh state and this has been and will continue to be one of the most important factors in fishery development. Some 45% of the total world production is consumed fresh.

Curing (drying, salting, smoking, marinating, etc.) absorbs about one-third of world supplies, consumed predominantly in Asia, the southern, central and eastern parts of Europe, the Belgian Congo and Brazil. This form of processing, developed from early primitive methods of sun drying and salting, now encompasses a wide variety of products of different flavors and appearance.

Canning began during the 1880's, and has now become a highly developed technique ; it absorbs 6.6% of supplies, and is of major importance in North America and of lesser importance, although well established, in Europe, Asia and the U.S.S.R.

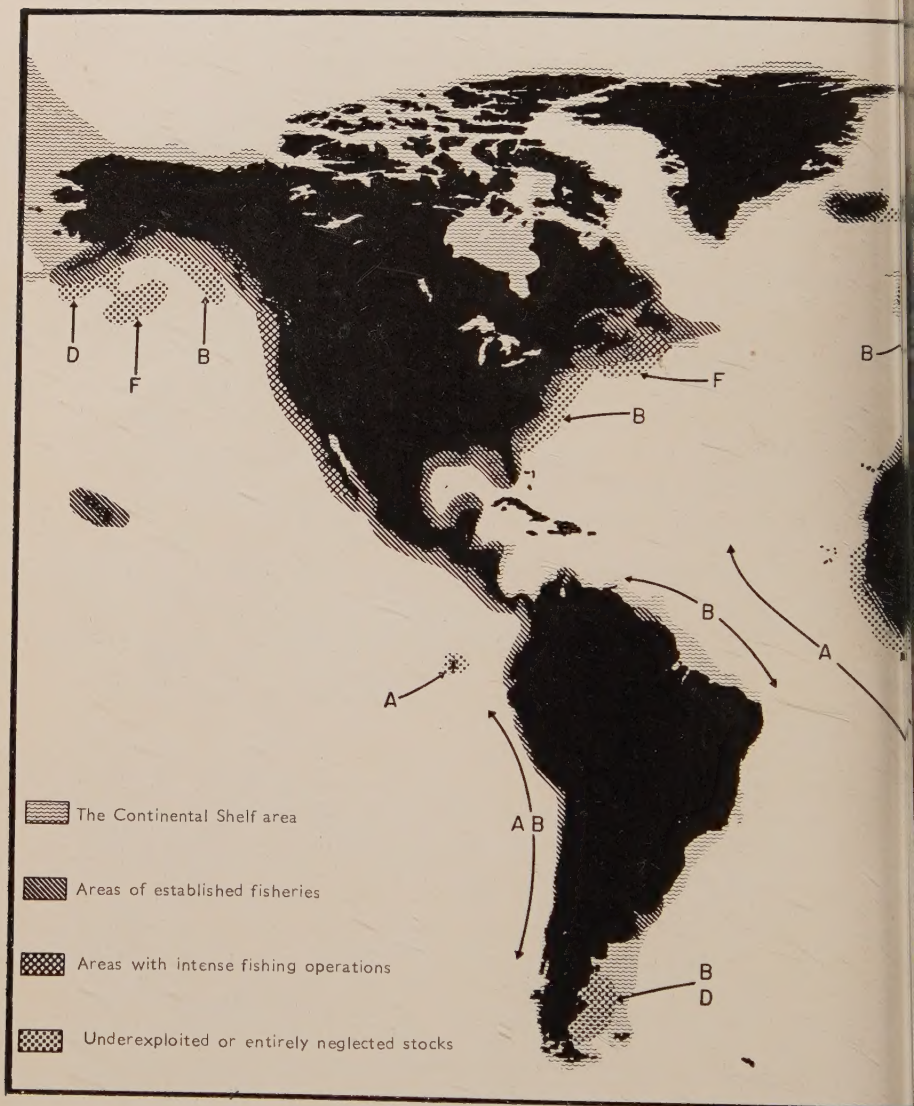

Figure 2. Marine fisheries of the world, showing areas of establi

Sources : After United Nations Department of Economic Affairs, *Proceed*
Vol. 7, Wildlife

A — Tuna

B — Clupeoid

C — Percomorph — as reef stocks

nsely exploited, and those under-exploited or entirely neglected.

s *Scientific Conference on the Conservation and Utilization of Resources*
w York, 1951.

— Gadoid
— Crustacea
— Redfish

TABLE 2 - ESTIMATED ANNUAL WORLD CATCH OF FISH, CRUSTACEANS, AND MOLLUSKS, MID-TWENTIETH CENTURY

Species Groups and their Utilization	World Total	Africa	America North[1]	America South	Asia[2]	Europe[2]	Oceania	U.S.S.R.
	..... Thousand metric tons							
Species Groups								
All teleostean fresh water and brackish-water species	4 600	100	100	100	3 500	100	ø	700
Salmon, trout, and similar species	600	—	300	—	100	ø	ø	200
Soles, flounders, halibuts, and other teleostean flatfishes..	600	ø	100	ø	200	200	ø	100
Cod, hake, haddock, and similar species.....	3 400	100	600	ø	300	2 200	ø	200
Herring, sardines, pilchards, and similar species.....	6 400	400	1 300	ø	2 000	2 100	ø	600
Tunas, true mackerels, and similar species	1 500	ø	300	200	700	200	100	ø
Other marine teleostean species[3]	5 000	100	400	200	3 000	800	ø	400
Sharks, rays, skates, and other elasmobranchs[4]	500	ø	ø	ø	200	100	ø	ø
Crustaceans and mollusks ...	2 700	100	700	ø	1 500	300	ø	100
Bêches-de-mer, turtles, seaweeds, and other aquatic fauna and flora[5].....	600	ø	ø	ø	500	ø	ø	ø
Total	**25 900**	**900**	**3 800**	**500**	**12 000**	**6 000**	**200**	**2 500**
Utilization								
Consumed fresh.....	11 600	300	1 100	300	5 800	2 800	100	1 200
Freezing	900	ø	500	ø	100	200	ø	ø
Curing.....	8 300	200	500	100	5 000	1 500	ø	1 000
Canning	1 700	100	900	100	200	200	ø	200
Reduction to oils and meals	2 700	300	800	ø	400	1 200	ø	ø
Other purposes	700	ø	ø	ø	500	100	ø	100

Source : FAO *Yearbook of Fisheries Statistics*, 1950-51, Rome, Italy, 1953, p. 3.
ø Negligible, for the purposes of this table.
[1]Includes Central America. — [2]Excludes the U.S.S.R. — [3]For the purpose of this table this group includes : (*a*) barracudas, mullets and similar species ; (*b*) jacks, pompanos, and similar species ; (*c*) perches, croakers, breams, basses, and similar species. — [4]For the purpose of this table this group includes ganoids : sturgeons, and garfish. — [5]Excluding aquatic mammals (baleen and sperm whales, dolphins, seals, etc.)

Freezing is the most modern of the processes used. Starting on a commercial scale in the late 1920's, it developed fairly rapidly during the '30s in North America, where it is now a major and growing section of the fishery industry. Frozen fish products account for only 3.5% of total catches, but use of the technique has increased in Europe since the war.

The reduction of fish into oil and meal has gained very rapidly in importance during the last ten years to deal with local and seasonal gluts of certain preponderant species, particularly of gadoid and clupeoid groups. The proportion of total world fish supplies taken by the oil and meal industry (more than 10%) includes one-third of the African catch and one-fifth of the catch in Europe and North America.

While, because of limited marketable life, the bulk of world fish supplies has been, and is still, absorbed by domestic consumption, the developments in preservation and transport have gradually facilitated a wider distribution, so that now some 20% of the world's catch enters

ernational trade. Generally speaking, most of this trade is intra-ional, but some commodities are now exchanged inter-regionally. e developments in Scandinavia and South Africa particularly have ought Africa and Europe to the position of being net exporting re-ns. The most important individual countries with a net export (1950 export quantities in tons) are : Canada (179,108), Denmark (81,041), ench Morocco (78,661), Iceland (141,414), Japan (56,123), Nether-nds (12,678), Norway (488,115), Union of South Africa and South-st Africa (41,498). Some of the important producing countries are efly dependent on export markets for disposal of their catches (in ocessed form), since their populations are small and thus the do-stic demand is necessarily restricted.

Past Developments

These features of the world's fisheries and the differences of de-lopment which they reflect can be made somewhat clearer by a dy of the history of the fisheries of the major fish producing coun-ies during the past forty years.

TABLE 3 - CATCHES OF MAJOR FISH PRODUCING COUNTRIES, 1910-52

Country	1910	1930	1938	1952
	..... Thousand metric tons			
ina	*2 000	...	...	*3 000
an.	*2 000	3 267	3 601	4 674
rway	630	995	1 065	1 799
ited Kingdom	1 162	1 152	1 097	1 100
ited States (including Alaska)	1 000	1 485	1 927	2 344
S.S.R.	*1 000	...	...	*2 500
Total	*8 000	...	...	*16 000

urce : Official publications.
lough estimates only : no statistics available to FAO.

The present estimates of world production indicate that these x countries now produce 61.2% of world production. The above able indicates that these countries more than doubled their catch forty years (from 1910 to 1950) and the statistics for four of them dicate that a substantial increase was accomplished within the first alf of this period.

Thirteen other countries* which account for about 20% of the resent world production, increased their aggregate production by ver 160% from about 2 million tons in 1910 to 5.3 million tons in 952, and for some of these countries there has been a several-fold ncrease.

Although no information is available about the fisheries of the rest f the world in 1910 and, therefore, no world comparison may be made,

Belgium, Canada, (including Newfoundland), Denmark, Finland, France, Germany, eland, Italy, Netherlands, Portugal, Spain, Sweden and the Union of South Africa.

there are grounds for believing that only small increases took place. B the more reliable estimates now possible indicate that some 25 cou tries, which now produce about 75% of total supplies, have increas their combined production by 100 to 150% during the last forty yea

Much of the expansion has derived, in fact, from the development single, unit fisheries. *Norway's* increased production since World War I for example, reflects her more intensive exploitation of the wint herring stocks, as a result of which total Norwegian production of he ring has doubled since about 1938. In the *United Kingdom*, the deve opment of heavily capitalized distant water fisheries, based on th cod stocks of Bear Island and the Barents Sea, was even sufficient t offset, in volume, the serious decline in the herring and North Sea tra fisheries. In fact the North Sea provided the cradle of modern trawlin where, following the discovery of rich plaice and haddock ground the western European countries rapidly increased their trawling fleet

Most of the increase in *Icelandic* production consists of cod, which the catches are now 100% greater than prewar, and, con spicuously, of redfish, production of which is some 100,000 tons abov its negligible prewar level. In the *United States*, the tuna, from being virtually unexploited species, has come to be one of the major commer cial fish products, supporting a costly processing and distributive or ganization and some of the most heavily capitalized fishing in th world. The dramatic increase in *South Africa's* production since th war resulted mainly from the meal and oil industry based on prolifi stocks of pilchard. The postwar demand for meals and oils, and th massive agricultural program in the *United States* also extended th rapid and intensive fishing of menhaden.

On a smaller scale, many references might be made to increase which were nevertheless impressive because of the short periods an the small number of units involved. Thus, between 1929 and 1937 *Germany* increased the production of herring alone from just over 3,000 tons to over 130,000 tons (5). Between 1930 and 1935, the *U.S.S.R.* increased the output of preserved herring from the Murman coast fisheries from 1,000 to 99,000 tons (5).

It should be noted that these increases come from stocks which (with possibly the exception of South African pilchard) at least were known and which, in many cases, were subject to some exploitation.

1.3 *Factors Influencing Past Development*

The technical means whereby the increases were achieved varied with the location of the resources and their accessibility to the fleets which different countries could bring to bear upon them. In *Europe* and *North America*, the advent of steam and internal combustion engines, and improvements in navigational aids, reduced the problem of distance, while mechanical assistance in the operations quickly brought trawling, gill netting and seining to a peak of efficiency which magnified the productivity of the labor employed. The fresh fish markets of Europe came to be supplied from grounds thousands of miles away,

nd even shipboard processing and preservation is becoming possible t the larger, costlier vessels.

By contrast, *Japan's* huge production is derived mainly from the roximity of abundant resources in coastal waters, readily accessible the manual techniques of a large fishing population, and to a lesser xtent from short-range trawling operations, and from mother ship perations on distant grounds engaging numerous small units. Simirly, the prolific coastal stocks of *Norway* were exploited easily from mparatively small well-found craft using improved gears, including ne modern purse seine, and drift nets.

Research developed in support of these great industries and supplied essential information about the fish stocks, adding to and improving the use of empirical data amassed by generations of fishermen. It is to be stressed that these great expansions arose in the first instance rom the energy and will for change among the operatives, and was nade possible by their integration in national economy. Thus, the great apanese expansion was brought about by a great national drive to which the Government and all sections of the community lent support.

The capacity to handle and distribute overland this increasing production from the seas was greatly enlarged by the development f transport systems and of a food technology adapted to the marketing f perishable foodstuffs. Rising levels of education, training and commercial acumen supported the application of technical experience and facilitated the growth of business organization directed to the profitable exploitation of trading opportunities. Hardy, vigorous seafaring populations were on hand to accept the rigors of fishing and to gamble their safety against the chance of large, if infrequent, rewards. It is clear from the identity of the countries concerned that the major increases in this period, and even earlier, reflected the general swing rom predominantly agricultural to more industrial economies and he consequent capacity to provide the experience, equipment and facilities required for the exploitation of marine resources. Historically, therefore, fishing intensity is inextricably linked with the more varied skills available in industrialized countries, with the more abundant, nutritious and varied diet which the higher incomes of those countries made possible and, of course, with the descending level of self-sufficiency in agricultural production. Such a global appraisal, however, masks the varying pace at which increases occurred and the significant fact that they occurred as a result of activities undertaken spontaneously in response to an expressed or foreseeable demand. Generally speaking, the problem has always been : " How much is required by the market ?," rather than : " How can it be taken ?," and generally technological and commercial experience has been well ahead of fishing practice. It is only comparatively recently that the biological appraisal of major resources has indicated ceilings to production differing from those dictated by the level of demand.

Further increases in world supplies must, however, take place in a very different environment. In part of the Northern Hemisphere where both traditional markets and resources are closer to saturation

they will depend chiefly on wider trading opportunities whose creation and maintenance might be beyond the control of private commercial organization alone. In other parts of the Northern Hemisphere and in the Southern Hemisphere, where we must look for the major increases, not only are the relations between land and water masses entirely different (and perhaps also those between the biological and hydrographic factors), but the expansions and technical changes must be of such novelty that often they will be beyond the capacity of the present industries. Moreover, the potential demand, albeit tremendous when measured by the need, is still latent, dormant or frustrated by poverty ; and production to the level of the theoretical total demand, and even to intermediate levels, is quite beyond the capacity of the independent limited activities of ill-equipped fishing populations. Increases here will depend largely, therefore, on the deliberate intervention of governments in order to force the pace and to compensate temporarily for the absence of those factors which elsewhere have favored rapid fishery development. But at the same time they will depend also on general technical changes in the country (improved transport and so forth) and on general economic improvements which, with raised standards of living, will release the potential demand from its present restraints. These are the conditions which have influenced present estimates of global increases, and which will be discussed in the ensuing sections of this paper.

2. The Basis for Expansion

2.1 *The Productivity of Waters*

The starting point of productivity in waters, as on land, is assimilation by plants. Current views on productivity are summarized in a recent article in this Bulletin by Professor Sverdrup (6) who states that, according to the latest estimates, primary production of the sea is about equal to that of the land; the primary production of *all* waters then exceeds that of the land. However, whereas on land much of the food is taken from the plant stage of the production chain, from the waters this stage is utilized only to a small degree, as seaweeds, and consequently the food supply from the waters is a much smaller proportion of the total primary production than is the case on land. Presumably, although Professor Sverdrup does not directly say so, the primary production on land to which he refers includes the cultivated, husbanded and fertilized production of grains, fruit and vegetables, comparable with which there is almost none in the waters, especially in the seas, and this accentuates the comparison. Cultivation of fish in inland waters is well established in some countries and undoubtedly could be carried much further but this is at a later stage of the cycle. The possibilities of more direct intervention in the productivity cycles of the sea seem much more remote although recent work on fertilization of lochs, bays and other partially enclosed bodies of sea water might prove to be the thin end of the wedge (7). At

this stage notice must be taken of the vast accumulations of nutrient materials which lie on the floors of the oceans, from some of which comes replenishment of surface waters, as described by Professor Sverdrup. There are such reserves, however, which apparently remain undisturbed and unused; the possibility that these might eventually be brought into use, by means of what could be described as artificial upwellings, could not be entirely ruled out although the economic and technical aspects of such an enterprise might make it something only for the very remote future.

To whatever degree the primary production of the waters might eventually be increased by cultivation, the waters surely could yield more foodstuffs from the plant stage of the production cycles. At present the quantities of seaweeds taken are considerable, yet careful surveys in various parts of the world indicate that such harvests represent only a very small fraction of the measurable stands of weeds. Dr. Woodward (8) estimates Scotland could produce from 70,000 to 10,000 tons of carbohydrate annually from seaweeds, depending upon the time of the year in which the weed is harvested; he has estimated that on 4,500 miles of Scottish coast there grow ten million tons of brown seaweeds from which an annual harvest of one million tons could be taken — and this estimate of yield allows for inaccessible beds and for a four-year recovery plan. He further estimates that at least 60 million tons of these weeds grow on the coasts of Norway, France, the British Isles, Canada, the United States and Falkland Islands. To speculate on the magnitude of the total growth of such weeds throughout the world leads one into figures of astronomic dimensions. Beyond this possibility there remain other elements of the aquatic flora. On the one hand, use is made of weeds from fresh water ponds to provide green manure for fields and probably a much greater contribution to food supplies could be obtained from the waters in this way, even though indirectly. On the other hand, there is the suggestion that substantial quantities of food could be obtained directly by using the phytoplankton; many people point out that this corresponds to suggesting that man should eat grass (9), and others believe that man could not invent equipment to operate more efficiently in collecting phytoplankton than nature has achieved with the organisms which at present feed on it, nor derive nourishment from phytoplankton as successfully as he does through fish.

Before turning to the resources of fish as generally exploited at present, mention must be made of zooplankton. This is an obvious resource whose dimensions are considerable; estimates of the zooplankton communities of the Antarctic, and of the quantities consumed by whales, are both in the order of many millions of tons (10). Although serious attempts have been made from time to time under governmental sponsorship to develop industrial uses for zooplankton in western countries, there is in these countries a scepticism about its value; this, however, overlooks the fact that considerable quantities of zooplankton are at present used in Asian countries for the manufacture of pastes and other fishery products (11). Of course, the

technical problems, such as those of finding concentrations of the zooplankton and of catching it, would be formidable — in the East, there is the fortunate circumstance that such concentrations occur in places of technical and economic convenience, however, this is not a resource to be overlooked, and its use would have the great advantage that it would be an exploitation of a stage of the production cycle lower and therefore more efficient, than fish.

At the outset it should be said that it seems unlikely that production from any of the existing fisheries need fall substantially and permanently below their present level of production ; certain fisheries undoubtedly contain the elements of overfishing which, unrestrained could lead to gross depletion of the stocks. The stocks of fish in the North Sea and of whales in the Antarctic are examples of resources which are in this danger. But even these could (perhaps not even excepting the whale stocks) be held at present levels by appropriate adjustment of the fishing effort. It is impossible to say that the Antarctic whale stocks could not diminish to the same degree as those of the Arctic ; nor could it be said that phenomenal fluctuations, such as those which have characterized the California and Atlantic sardine fisheries, would not, under subsequently developed circumstances, appear in other fisheries. But it seems safe enough to believe that the existing stocks could continue to produce at approximately their current level. Therefore, any expansion of operations beyond present limits which may be forecast must necessarily bring about increases in the total supply unless socio-economic or other factors should cause a reduction of effort in existing industries.

The fishing industry differs from agriculture in that whereas agriculture can measure the availability of its resources, the fishing industry cannot — or at least cannot in the present state of our knowledge. The boundaries of fishing areas shown in Figure 2 are fairly well defined in a few cases, in others they are at best vague ; consequently the marking on this map is provisional. Yet, it is clear that the fishing areas constitute only a small proportion of the total area of water surface in the world. For instance, it has been pointed out that the bulk of the fishing takes place on the continental shelves which form only 10% of the marine area (12). Now, whilst there is no suggestion that the whole of the water surface is expected to yield fish, nor that fishing operations could be brought to the same intensity and productivity in all fishing areas, it is unquestionable that more areas could be brought under exploitation and that even areas fished at present could be brought to yield more.

The examination of these possibilities should begin with a consideration of current fisheries in an attempt to measure the increases possible in them within their existing limits ; to this should then be added estimates of increases which could be gained by extension beyond these existing limits upon already located stocks.

The inland waters constitute an important sector in which substantially increased production will most certainly take place.

ne present production, estimated at 4.6 million tons, is drawn from:

1. subsistence operations on wild stocks in the lakes and rivers of the Asian continent, notably India and China and of Latin America;
2. commercial fishing in the Great Lakes of Canada and the United States, British East Africa, China and Cambodia and from the river systems of Europe and other continents;
3. cultural operations in fresh water in China, India and Japan, and brackish water in Taiwan, the Philippines and Indonesia.

A notable section of the fresh water production is drawn from et rice paddy fields. In respect of the wild stocks, it is certain that reat increases of production can be expected from the use of intelgent inland fishery management, with control of fishing, improvent of waterways, protection of migratory paths, and similar measres. Fish culture could provide great increases: there are innumrable bodies of impounded waters, from small domestic ponds great reservoirs, which could be cultivated; there are great reas of wet rice cultivation; and there are vast areas of swampy, rackish, foreshore areas which could be used for cultivation after ne style practised in Indonesia and the Philippines. For the Indoacific region alone, the area of cultivable inland water is estimated t 37 million hectares (13) which, even with only moderate average roduction per hectare, would mean a very considerable yield.

The production from the seas may be considered first on the asis of broad taxonomic groups, as shown in Table 2.

It will be seen that the clupeoids constitute the most important roup, and this importance is of even greater significance in that the umber of species of which the group is composed is much smaller han that of the nearest other group. The principal fisheries for cluoids are discussed earlier (pp. 164); the prospects of these may e summarized as follows:

In certain cases there is good reason to believe that the fluctutions which occur in production are in large part due to economic actors (chiefly demand) and that output could be increased if these ould be controlled. In this category would fall the Norwegian herring atch and that of menhaden (14) in the United States.

In other cases great fluctuations occur apparently because of naural factors. In this group fall the California and Atlantic sardine 15) and the Indian oil sardine (16). In the latter case there are reons for believing that the fluctuations are in the accessibility to the xisting gear rather than in abundance of the stock. Determination f the behavior of the fish and changes in equipment to permit the ishermen to pursue the fish would presumably bring the average nnual catch much nearer the peak catches which occur so irregularly, if not carry it beyond this level. This would mean a contribution in the order of hundreds of thousands of tons per annum.

A third group of cases includes those situations where the ishery is negligible and where it is held with varying degrees of

confidence that big fisheries could be established. This includes the occurrences of Indian oil sardine and similar species in the Arabian Sea and Persian Gulf (17), the known occurrence of pilchards in the southern waters off Australia (18), and the pilchards off the west coast of South America (19). Mention should also be made of the occurrence of pilchards in the English Channel which is described as vast (20). Whilst the fisheries which might develop to exploit these stocks undoubtedly would vary in size and regularity, an indication of the possibility may reasonably be taken from the development of the South African pilchard fishery which, although already yielding more than 400,000 tons after little more than eight years of development, is thought to be capable of further growth (21).

The next important group is that which is described as "Other Marine Teleostean Species" which is made up generally of percomorph species. The carangids constitute a particularly important section of this group. Whilst this group occurs in the catches of most areas of the world, and of probably all fisheries which take a mixed catch, it is of particular importance in tropical regions. A large part of the catch in the Indo-Pacific (22), and of tropical Africa and America consists of this group. There are both pelagic and demersal species in the group, one of the favorite habitats for which is the water overlying a coral and generally reefy bottom. There are considerable stretches of such ground in northern Australian waters (23), in Indonesian and Philippine waters (24), in the South China Sea, off the African coast, especially in the Mauritius-Seychelles (25) area and northwards, and in the Caribbean. The existing fisheries for this group are generally restricted in scope, with yields in the order of units or tens of thousands of tons per year.

Next in importance among these groups is that of the gadoids: cod, hake, haddock and similar species. Although these are essentially demersal fish, there is evidence that they also move in middle waters so that the abundance indications from bottom trawling are to that extent defective. Nevertheless, available evidence suggests that the stocks of cod in northern waters are underfished (26). Prognostication of the future of fisheries based on species in this group, such as those of the North Sea, the Norwegian Sea, the Arctic fisheries, and the Newfoundland Banks, calls now for more precise appraisal of extensive data on the condition of stocks.

The tunas, true mackerels, and similar species constitute a group of great diversity whose exploitation presents problems essentially of their own. The tunas, of course, have received considerable attention during recent years, but they continue to be a most elusive group. However, there is much evidence to support the view that greater quantities of tuna are available for exploitation; areas which seem to carry promise of this include the central and north Pacific, the waters of and surrounding the Philippine and Indonesian archipelagos, and the northern Indian Ocean (27). The greatest importance lies, perhaps, in the fact that pursuit of them is leading fishermen out into the broader stretches of the oceans. Professor Sverdrup (6) believes

that the oceans include no areas which are barren as are deserts on land ; whilst some persons might think that in degree certain parts of the oceans approach closely to being deserts, and whilst it is apparently futile to speculate about stocks of fish on the floor of abyssal depths, nevertheless it should be kept in view that the broad oceans could yield greater quantities of fish. The industrial interest in the tunas gives economic support for the presence of fish-searching vessels in these areas. This group includes the mackerels which are thought to be under-exploited in some areas because of lack of interest on the part of industry or other economic impediment, or because of inadequate knowledge of their behavior coupled with technical inadequacy of equipment. The mackerel of the North Sea are thought to be of the former type (28), and perhaps *Rastrelliger kanagurta* (in Thai : *Pla-thu* ; in Malay : *Kembong*) in the eastern section of its distribution. The latter (*Rastrelliger* sp.) also might be underfished on the Indian west coast because of what are thought to be the great fluctuations in its availability (16).

After these four groups there remain, among marine fishes (in the more common meaning) two other groups : firstly, the flatfish, and secondly, the sharks and rays. Walford (29) said that only 10% of known plaice grounds were being fished which must signify an important possibility of increase, and it may be assumed that similar possibilities (if not of the same magnitude) exist in respect of other species in this group. In respect of the elasmobranchs, although there is clear evidence from several fisheries that stocks of fish of this group have limited potential (30), and thus can fairly easily be brought to a low yield level, still the occurrence of this group in large, relatively neglected areas, such as the Red Sea (31), signifies a real possibility of increase.

A very important section of the total aquatic production is that consisting of crustacea and mollusks. Although the possibility might be small of there being important unexploited natural stocks of the latter, there exist extensive areas of foreshore on which cultivation could be undertaken. Within this century important new resources of crustacea have been located and brought under exploitation : off the American east coast (32), off the east coast of Australia (33), and in the Mexican Gulf (34). Resources of crayfish, which had been sporadically fished off South Africa (35) and Western Australia, (36) have recently been brought under increased exploitation. These experiences coupled with evidence on the abundance of these resources in other areas where exploitation is much older [e.g. Norway (37), Sumatra (38)], suggest that, following similar ecological guides, other important resources should become available — reference might be made to the obvious eligibility for investigation of the areas of the Bay of Bengal off the mouths of the Ganges, Godavari and other great rivers, and of similar areas off the mouths of the great rivers of New Guinea and Borneo.

2.2 *The Technical Aspects of Realizing these Possibilities*

In the foregoing brief analysis of fisheries resources of the world and of evidence on the possibilities of their yielding greater supplies of food, there has grown a pattern of types of opportunity. This may be summarized as follows :

1. Among existing fisheries there are some whose output perhaps could not be increased substantially, but in which there might at least, by increase in efficiency, be some economy of effort, and improvement in the quality and the flow of supplies.
2. Others of the existing fisheries could be extended in operation and led to furnish greater production.
3. There are species which, subject to exploitation in certain areas, are neglected in others, despite knowledge of their presence.
4. There are certain areas which are virtually neglected altogether.
5. There are certain resources, e.g. phytoplankton, zooplankton, and even the nutrient reserves of the oceans, whose exploitation should be held in mind as eventual developments.

The realization of such possibilities as these biologically indicated will depend upon technical considerations on the one hand and economic on the other. We shall, in the first place, examine evidence on the technical means of realizing these possibilities.

In each of these categories of situation there is the same technical task falling into three phases : to find fish, to catch them, and to get the catch to the consumer. The activities in these phases differ, of course, according to whether a fishery is in an exploratory, developmental (or appraisal) or steady (sometimes conservational) stage. Further complications arise where fish culture and inland fisheries management are concerned, although these can be treated as subdivisions of the principal stages listed.

2.21 *Fish finding*

The increased mobility (range and speed) that fishing craft have gained from the use of mechanical power and from improvements in design, and the rather dramatic advances which have been made in fish-searching equipment (39) such as echo sounders, Asdic and aerial observation, have added greatly to the fish finding ability of the fishing fleets and, of course, of exploratory vessels. Also there are indications that the noises fish make underwater, and perhaps other indications of their whereabouts, may be usable. Moreover, there are the considerable contributions which have come from radio, radar, and direction-finding equipment, which have served to improve

nvigation and to make available to the fisherman latest information
n location of the fleet, and on weather. These improvements have
ie advantage not only of taking the fisherman more directly
id safely to his fishing grounds, but also of reducing the weather
izard inherent in fishing operations. * This ability can be further
:tended by the contribution which will be made by biology in
escribing the behavior and distribution of fish and the relations
hich exist between fish behavior and various elements of the environ-
ent. This contribution will be of two kinds : first, the longer-range
rediction of the general limits within which, in each season, it will be
:pected that the fish will occur: secondly, the more precise description
the environmental vectors determining the distribution of the fish,
d, from this description, the preparation of instructions for the use
equipment, such as plankton indicators, and bathythermographs, and
e interpretation of data obtained from their use. To these develop-
ents must be added a statistical methodology to serve as basis for
e use of these instruments in searching work ; this methodology no
ubt will have greatest application in exploratory work. Improvements
these kinds will reduce the fish-searching time, and conversely increase
e effective fishing time, and will enable the fisherman more efficiently
place his gear in position to catch the fish ; an important example
the latter benefit is the effective placement of sub-surface purse
ines and floating, off-the-bottom trawls by the aid of echo sounders.

At this point, for two reasons, a reference must be made to elec-
cal fishing (41). First, because this is, in a sense, a fish finding equip-
ent; secondly, because the possibility has been mooted that electrical
uipment should be used at sea to direct and control the move-
ent of fish and, eventually, to place barriers, or fences, round fish. This
ggestion seems, of course, almost fantastic, even remembering the
:cess with which such equipment has been used in fresh water (e.g for
rriers in irrigation and water supply systems). However, the sug-
stion has this particular virtue that it directs attention upon the
st phase of an important change in method which is undoubtedly
xing place in sea fisheries, namely, the conversion from hunting to a
id of animal husbandry. Already, of course, fish culture is a type of
imal husbandry. When, however, the fisherman will be able to know
th reliability (whether or not because he has fenced them with
ctricity) where to find fish and be able to conduct his fishing as
leliberate and planned operation to round up a specific proportion of
measured stock there will be removed from the fishery industries
principal part of the risk element which at present makes its po-
ion a weak one. The implications of these thoughts lead into
estions of fishery management which will be better discussed in
nection with catching.

To summarize it may be said that although some of the fisheries
the world still remain at the mercy of the vagaries of the move-

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t should be noted that any improvement which enables the fisherman to work
:e directly, speedily and efficiently to his objective, contributes to this reduction
weather hazard by enabling him to achieve his objective in a shorter time (40).

ments of the fish, technical advances are taking place to eliminate this uncertainty in fishing operations, and it may be expected with confidence, that this uncertainty will reduce in the future. In addition, this and other advances are steadily improving the means whereby the location and general distributional limits of new resources may be established. The implications of these developments in relation to the first four of the biological possibilities listed on page 171 are obvious.

2.22 *Fish catching*

The problems must be considered in this phase under three headings, namely: the technical aspects of the fishing operation itself; the bio-economic aspects of the fishing operations; and the general economic aspects of fleet efficiency. In respect of the first it may be noted that almost innumerable developments have taken place recently to increase the fishing power of the fleets. Fishing craft are constantly being improved in power and design to adapt them to their particular tasks (42). In certain underdeveloped countries mechanization is taking place and this is enabling the fishermen to extend their range of operations, to use larger and more effective gear, to reduce their travel time between port and fishing grounds, and to achieve general improvement in the standard of their operations. Modern equipment from more advanced countries is having similar effects in underdeveloped countries, and in developed industries improvements continue to be made in fishing gear, with new types of floats, floating trawls, hydrodynamic lifting planes, modifications of trolling and longlining, and the development of new principles in fishing methods, e.g. electric fishing. Some extremely illuminating results have already been obtained by the use of underwater cameras and television in the study of the working of fishing gear and it may be expected that on the basis of these studies gear technology will make further contributions. The use of light and livebait to bring fish toward or into the fishing gear is opening up a number of areas, and the possibility exists that chemicals and eletricity might be used for these purposes (42 and 43).

Whilst there still is some controversy over the advantages to be gained from conservational measures, there is confidence in many quarters as to the benefits to be derived from such measures. The Minister of Agriculture and Fisheries in London (44) has said, "Taking three main species — plaice, haddock and cod — the estimate comes out that about half the fishing of the 1930's would give 20% greater weight from the North Sea over a run of years estimate. Steps in this direction would give gains in proportion: more and better fish with less spent on catching them." This statement is in conformity with the decision taken by a group of nations to establish a permanent commission to regulate the fisheries of the North Sea, and this action has continuity with earlier action which established the Commissions for halibut and salmon in North America. Whilst readily admitting the

l-designed, conservational programs have from time to time been imosed upon certain fisheries, it may nevertheless be held, with much onfidence, that in the long run the efficient maintenance of marine sheries will include within the management program provisions rresponding to, if not exactly the same as, conservational measures s at present understood.

One of the major arguments developed by Michael Graham (45) as been that unplanned fishing not only induces certain effects within ie fish population, which in due course manifest themselves in the tch, but, also, is accompanied by avoidable wastage of effort. It is monstrable that there could be effective redistribution of fishing wer which, while serving the purposes of adjustment of effort nearer the sustained yielding power of the resources, would confer great onomic advantages on the fleets and contribute to the direction of hing effort upon under-exploited resources. These suggestions lead to the entire question of organization of the industry, to the shore cilities which must be provided for unloading fishing craft, fuelling, ovisioning and servicing them generally ; cold storage, markets; broadst services, and so forth. Coupled with this, there is the question of ined personnel to undertake the skilled work required.

To summarize in respect of the fish catching techniques, we may y that these also are developing towards a substantial reduction of the certainty of fishing operations, and that, coupled with the advances fish finding, the conclusion is that fishing operations are becoming adily more certain and, therefore, that they should be more susceple to national planning in relation to the potential of the stocks.

13 *Fish handling*

One way of increasing the world's food supplies from fisheries thout increasing present catches is their better utilization which n be achieved in at least two ways : (*a*) by making use of less popular d rejected species which are caught incidentally, as well as by better lization of the wasted parts from regular catches and, (*b*) by preveng, or at least reducing, spoilage of fish in the time between the removal m the water and consumption.

Among the former methods should be mentioned the utilization previously unmarketable species through new forms of presentation h as the successful marketing of skinned fillets of rosefish (as ocean ch) after it had been found that dressed rosefish was unacceptable l the trawlers had dumped thousands of tons annually when fishing cod and haddock. A whole new industry was thus created in New England states (U.S.A.), with rosefish landings increasing m 120 tons in 1932 to over 94,000 tons in 1950 (46). In other instan, new forms of preserving, such as smoking, soft curing and freezing whale meat), have produced new acceptable foods from raw mate- which in the fresh form were not formerly marketable and thus e wasted altogether by dumping at sea or used only as fertilizers. New ways of saving waste parts and offal by the introduction of

small fish meal plant units (47) ; the installation of meal plants in large trawlers and in whaling ships ; and the saving in the form of fish and whale solubles and whole meal, of nutrients formerly wasted in the stickwater, * have all contributed, at least indirectly, to the food supplies available to man by their use in animal feeds.

The prevention of spoilage of fish flesh is being studied in many fisheries technological laboratories. It is realized more and more that this battle must start when the fish is removed from the water, indeed, as soon as it hits the gear, and must continue until it is sold to the consumer ; this task is, therefore, the combined responsibility of the fisherman, processor, dealer, shipper, wholesaler and retailer. Neglect at any stage in this whole chain will reduce the keeping quality of the fish and lead to waste, and no subsequent measure of processing or preserving can restore good quality lost through neglect at an earlier stage of handling. The first responsibility lies with the fisherman and skipper to ensure that the fish are landed in good quality. This calls for improved physical equipment—well insulated and refrigerated fish holds, constructed of impervious materials (e.g. non-corrosive, light metal) — as well as improved handling and stowing methods aboard. The importance of early bleeding and removal of viscera, thorough washing and careful icing or salting aboard, is becoming more generally recognized.

In order to preserve the sea-fresh quality of fish on long fishing trips, the technical and economic possibilities of bulk freezing of round fish on board are being investigated in several countries ; the results indicate that fish can be landed in prime quality and thawed, filleted and re-frozen or presented in other forms.

In the second stage of handling, i.e. the landing, unloading and marketing of the catches, the quality of the fish can be safeguarded and waste avoided in many ways. Landing facilities can be improved and catches discharged more promptly and speedily. Fish piers, auction and market buildings should be such that fish can be handled and displayed under sanitary conditions and protected from the weather (especially in hot climates) ; adequate supplies of crushed ice should be easily available, containers should be sanitary and regularly cleansed, and transport facilities should be adequate to distribute the landings promptly to processors, wholesalers and inland markets. Similar steps should be taken to maintain quality at the wholesale and retail stages.

These measures, throughout, call not only for adequate premises, equipment and handling methods, but above all for trained personnel with special technical knowledge and skill, at all stages of the chain.

Where fish landings exceed the current market demands for fresh fish the surplus must be preserved for future consumption to avoid waste. Research has shown that many of the age-old processing methods, such as drying and smoking, can be carried on under mechanized, controlled conditions, which eliminate the spoilage resulting from uncertain weather and other factors, and improve the taste appeal as well

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* Stickwater is the liquid fraction which comes from the pressing of cooked fish in the preparation of fish meal.

as the keeping quality. New markets for fish can be opened with new forms of preserved products, such as frozen, canned, soft-cured ones, where the older types of pickle curing, hard drying, hard smoking, etc., have gradually lost favor in many markets. Such improved processing methods, as well as the introduction of new methods (fish silage, edible fish flours, etc.), make it possible to ship fisheries products longer distances, maintain their quality in storage for longer periods and thus save for human consumption large proportions of fish landings which in bygone days went to waste.

Thus it would seem that techniques are available for use, where appropriate, to accomplish any of the requirements in respect of holding, moving and displaying fish.

2.24 *Fish culture and inland fisheries management*

In this field numerous technical advances have made it possible to intervene directly and effectively in the biological processes of inland waters(48). In open environments much success has been achieved by the use of electric and other barriers for guiding the movement of fish, especially away from unfavorable environment, and in the design and installation of fish ladders and lifts with which to maintain the natural highways of their movement. These engineering activities can do much to preserve the natural fish fauna of open waters and permit programs for increasing the stock. On the biological side much can be done in planting stock in these waters, including the planting of new species to occupy special niches in the environment and to develop better ecological balance. In the same sense undesirable species may be eliminated by biological and technical methods ; and this applies in particular to the elimination of undesirable plant species (weeds) by the use of 2,4-D and other chemicals. Further steps can be taken to enrich waters in order to improve the food supply and, in some cases, artificial feeding may be worthwhile. These methods are applicable in the relatively enclosed systems but are even more applicable in completely enclosed systems such as ponds, where fish culture in its fullest sense may be applied. The evidence is that the available technical means place great power in the hands of the fishermen to improve the inland water environment and to increase its productivity.

2.3 *An Appraisal of these Possibilities*

Earlier in this survey it was stated that there seemed to be no reason why any of the existing fisheries should be obliged, for biological or technical reasons, to reduce its production substantially and permanently, and that, by contrast, there seemed to be many instances among the fishery resources where opportunity existed to extend and increase exploitation and, moreover, that the technical means to do so seemed, in general, to be available. This is the general direction in which the available evidence tends, and it is supported by separate estimates made

by various countries, apart from estimates such as that made by the United Kingdom that North Sea production could be increased 20% by effective management (44).

Thus, the United States (49) has estimated that the total domestic catch should increase from 2 million tons in 1951 to 2.4 million tons in 1957 and to 2.9 million tons by 1975. This estimate is based largely on the evidence of steady increase from a catch of 1.4 million tons from 1930-34 to 2.2 million tons in 1950. The change from 1951 to 1957 would be at an average annual rate of 3.5% and from 1957 to 1975 would be at an average annual rate of 1.2% and this would mean that the United States expects an increase of 17.6% in the catch from 1953 to 1960. Again, the U.S.S.R. (50), in the current five-year plan, hopes to raise the catch to more than twice the 1940 level. Production is reported to have increased already by 70% from 1.5 million tons in 1940 to 2.5 million tons in 1952 and the 1957 target, therefore, represents an increase of over 17% above the 1952 level. The Japanese Fisheries Agency has predicted that Japan's fish production will reach 5 million tons by 1957 as compared with 3.6 million tons in 1951. Preliminary figures show that production reached 4.7 million tons in 1952 and suggest that the 1957 target is well within reach (51).

In 1951, the production from these three countries was one-third of the world total. The total increase to be achieved by 1957 would be approximately 48% of the 1951 production, and, if that increase continued, production by 1960 would be in the order of 70% above 1951 which would give a 23% increase in world production even if no other increases took place. Whilst it is not possible to submit to close scrutiny the prospects of these countries achieving these targets, it is significant that these countries appear to find no biological or technical reasons why this should not be done. On the other hand this must not be taken to mean that similar progress is equally possible in other countries.

3. The Deterrents

It is manifest from the foregoing discussion that fisheries could produce much greater supplies of urgently needed food and that theoretically there are no major technical problems incapable of solution. The fact that an increase, although possible, is not taking place at a rate commensurate with the expansion of nutritional demands may be attributed to a number of deterrents applying in varying degree in different fishery situations (52). In some cases the incentive to produce and sell more is restrained by the low level at which the fishermen's need for food, shelter and clothing can be satisfied ; in others, ambition is frustrated by lack of financial resources or of profitable outlets ; while in many, and particularly in certain underdeveloped areas, there is neither incentive, nor means, nor outlet.

3.1 *Weaknesses in the Economic Background*

While it is a truism that there is a close interdependence between the fisheries and the general economic background, the effect of this interdependence on fishery activities is difficult to determine and has often been disregarded. For many reasons, of which the most obvious one is geographic, fishing communities have tended to isolate themselves from the general economic and social life of a country. The social characteristics of a seafaring life, the special skills required for the capture of different stocks, and the uncertainties of trading in unpredictable quantities of a perishable commodity have limited fishing experience to rather small segments of society. For this reason these communities, in common with other communities concerned with minor industries, have denied themselves the technical, economic and social advantages of communion with other sectors of society. At the same time there has been a tendency to overlook these communities in over-all national policies. This situation, of course, cannot be permitted in the major campaign which must now be fought for food supplies, in which the value of the production may not be determined only in terms of market price.

The relations vary greatly, which makes it the more difficult to recognize them clearly. In the highly developed economies of Europe and North America the development of fisheries has been, in many respects, well behind that of other industries, and the fisheries have, therefore, been able to draw upon great reserves of technological and commercial experience. Even so, notwithstanding their heavy investment in labor, equipment, materials and installations, these industries exercise only a marginal influence in food markets generally and their products are particularly vulnerable to competition from other foodstuffs. In many cases developed fishery industries have adopted conservative attitudes in an effort to protect themselves against economic failure, possibly with some loss of commercial opportunities. This is understandable in face of the fact that among the many interests which derive income fron the fish trade the primary producer usually carries by far the heaviest burden of financial risk. Unfortunately, many measures, both governmental and private, which have been applied with the objective of reducing risk, have not always resulted in maximum output; there has often been, and still is, restriction on production in the interests of sustained price, and much must be done in over-all development and economic integration before the grounds for such action will be removed.

In the underdeveloped countries the strategic importance of fisheries in the over-all economy may demand policies quite different from those applied in the developed countries. Where the levels of social and economic organization are so low that bare subsistence is the main objective, the fisherman may, in fact, have a nutritional self-sufficiency which many of his compatriots lack. This might explain the inertia which characterizes many of the world's more primitive fisheries and the comparative prevalence of subsistence fishing in the

Far East, Africa and some parts of Latin America. It is unlikely that fisheries can be effectively developed without some recognition of the need sometimes to catch up with the general economic advance, and at other times to await developments in other sectors of the economy. The failure to recognize this distinction has permitted people to embark on enterprises whose failure was inevitable because of the difference between the developmental levels of the attempted enterprise and the context into which it was to be placed. There is a danger in isolating fishery problems, especially in primitive commercial structures. In many places there is an opportunity for the fisheries, simply because they could be dramatically transformed by a fairly modest investment in equipment and training, actually to take the lead in over-all social and economic development, or at least to make a major contribution to that, provided they are deliberately integrated with the over-all development, and the limitations imposed by social and economic backwardness outside the industry are provided for.

3.2 *Ineffective Demand*

The importance of the demand factor is almost an overriding one. It would be possible to point to many places where production could be increased, but is not, because there is no prospect of disposing of the catch. In some cases the problem is one simply of organization and the provision of the physical means of transporting, storing and handling the fish. In other cases the situation is much more complex and related to problems of consumer preferences. In view of the fact that it is widely stated that fish production should be increased because there is a great need for the animal protein which it can supply, it is paradoxical that lack of demand should be a deterrent. But the truth is that the demand in some cases is not an effective one (that is, purchasing power is inadequate or irrationally expended) although the need is very great. There is also the question of geographic disparity between certain demands and the industrial potentials which could satisfy them.

The many factors which affect fish consumption vary in their influence in different regions. Ignorance of nutritional value, lack of access to supplies, unfamiliarity with certain products, fastidiousness, taboos and habitual preferences for other and often competitive foodstuffs, have produced regional differences and great differences between countries in the same region and between districts in the same country. In many parts of the world high prices, physical problems of distribution over long distances or difficult terrain and the failure to improve the appearance, quality and diversity of fishery products set up formidable barriers to expansion of the industries.

The inadequacy of what has so far been achieved in this direction is reflected in the pattern of inter- and postwar catches and utilization. The increasing preponderance of cod and herring products has, on the

one hand, required new techniques for handling and selling designed to sell more of these products in the competitive food markets of Europe and North America ; on the other, it has directed attention to the demand for animal feeds, fats and oils as a possible solution to marketing difficulties. During this period the world output of fish meal and oil (excluding that of Japan) has increased at a rate well above that of the catches. This is partly the direct result of the increase in the quantity of fish used for new forms of handling and processing (i. e. fillets), of the expansion of the canning industry, and of the better usage in the fish meal and oil industry of non-edible material rejected in the handling and processing.

Much fishery development has been associated with the increasing level of fish meal and oil production but in terms of the world food situation it will be very difficult to gauge the extent to which such development should be continued in the long-term. For example it might appear anomalous that the United States' menhaden fishery and the Norwegian herring fishery each supply annually for reduction purposes a quantity exceeding the total annual fish production of India. On the other hand, these productions supply animal feed which would otherwise need to be supplied from agriculture and, in any event, they reflect the limits of the demand for direct human consumption for an unpopular species. Similarly, the production of fish meal for export in countries where indigenous shortages of animal protein occur reflects an ineffective domestic demand for fish foods and a high world demand for animal feeds. It cannot, however, be taken for granted that the commercial success of these developments will necessarily justify the promotion of similar undertakings in underdeveloped countries where they may serve rather to retard the vigorous onslaught on marketing problems which will be required to translate consumer needs into effective demand.

3.3 *Defects in the Organizational Setting of the Fishery Industries and their Administration*

It is clear that the introduction of measures whereby technical education and high levels of consumption can be promoted, require, in varying proportions, considerable public and private administative organization. Commercially, the highly developed fisheries are sufficiently well organized to help themselves to a large extent, but except in a few countries where adequate fish supplies for consumption or export are of crucial economic importance, they are now facing marketing problems which, coupled as they are with heavy capital and operational costs, may require the application of special measures which are beyond the capacity of existing public or private organizations in many countries.

In the backward fishery economies the problem is much more urgent. The UN report, *Measures for the Economic Development of Underdeveloped Countries* (53), states that : " The first major obstacle to the general advance in technology in underdeveloped countries is,

therefore, the lack of an educational and administrative structure through which the producers can learn technology." It has become increasingly evident, in conducting development projects, that many of the economically underdeveloped countries have serious difficulties in drawing up and carrying into effect their fishery policies and this is often due to the inadequacy of public administration and commercial organization and their inexperience of various measures whereby fishery industries can be assisted to expand on a sound commercial basis. For example, the wide gap between governmental authority and the fishermen, and the lack of coherent and articulate organization amongst the latter, have so far made it difficult, and sometimes impracticable, to put equipment acquired through costly procurement programs into effective use. In many places the fishery administration is either rudimentary or non-existent, and there is virtually no agency, public or private, which can appraise the needs of the fishermen and carry administrative responsibility for measures of assistance.

3.4 *Problems in Financing the Industries*

The problem of finding capital for the acquisition of essential equipment is particularly acute in fisheries, where the special risks from fluctuations of supply and demand deter the ordinary investor. Development, therefore, has depended either on courageous private speculation or on planned financial assistance in the form of cheap credit facilities, direct or indirect subsidy, tax concessions and other incentives. Even in the most highly organized fisheries, cheap credit is proving to be a corner-stone of development, especially in the postwar rehabilitation, construction and replacement of fishing fleets. In the underdeveloped countries, the widespread indebtedness and poverty of the fishermen militate heavily against rapid development. The meager incomes deriving from primary production are often insufficient to finance even the replacement of essential equipment without the help of private loans, which serve only to perpetuate and increase the lien which middlemen, moneylenders and others have traditionally held on the fishermen. Increased production, based on improved techniques and equipment, is unlikely to occur on an extensive scale until this restraint is relaxed and cheap long-term credit facilities made available, and until the commercial organization permits the accumulation, collectively or individually, of financial reserves accruing directly from fishery activities.

The absence, or low level of private resources deters development in other directions. A considerable investment is required in harbor, market, processing, transport and ancillary undertakings, most of which will be a charge on public funds until the fisheries become established on a sound commercial footing and on a scale which will permit them to contribute to their own support. There is an urgent need to clarify the financial implications of fishery policy and to set up priorities in order to remove the contradiction frequently observed between heavy expenditure in one field and extreme financial re-

straint in others. In some underdeveloped countries expenditure is often planned without reference to the growth of income from the fisheries, and some heavy losses have resulted. In some situations, where resources are easily accessible, it may not be expedient in the initial stages of development to introduce costly labor-saving equipment, especially where other and better ways of spending the money are apparent.

3.5 *Barriers in International Trade*

The restrictive effect of unstable or low levels of demand, especially in Europe and North America, has been aggravated by the many and complex international trade problems arising from adverse balance of payments, unfavorable terms of trade, and the protection of domestic industry. There is a grave dilemma here, because the main export markets are in highly industrialized countries, where they also support heavily capitalized domestic industries. Fish products are particularly vulnerable to competitive imports in the generally unstable markets which the governments cannot protect without jeopardizing the economic stability of countries heavily dependent on fish exports, such as Denmark, Iceland and Norway, or frustrating the development of new exporters, like Angola, French Morocco, Peru and South Africa. In Europe particularly the liberalization measures applied to many commodities have been only piecemeal in the case of fish, and the intra-European fish trade in general is handicapped by a complexity of bilateral agreements, quantitative restrictions, tariffs, slow procedures, etc., with the result that some trading opportunities are lost which might be exploited under more flexible arrangements. In the underdeveloped areas the problem is not of such great significance, but might become so, and already postwar territorial boundaries are cutting off certain industries from their former traditional markets.

Mention must be made here of the various barriers, geographical, commercial and governmental, between areas of strong demand and industries capable of supplying them. Notwithstanding payments problems, there are markets in certain protein-deficient areas which could readily absorb surpluses from other regions if, for example, duties and taxes could be adjusted, and possibly if export credit guarantees could be extended over the long period required by some purchasers. While the problem is too complex to describe effectively in general terms, it is fairly evident that on the one hand temporary gluts occur undoubtedly as a result of imports, and on the other that some markets are starved of supplies as a result of protection.

3.6 *Shortcomings in the Orientation and Conduct of Research*

The direction and level of contemporary research has always been of special economic importance to fisheries because of the limitations imposed by fluctuations in the resource and the perishability of the catches. The relative poverty of the fishery industries has virtually precluded privately financed research, while their marginal economic

status has been both responsible for, and partly due to, the limited interest of public research institutions. Nevertheless, the application of techiques and equipment deriving from external research activities, especially in technology, has been effective enough to indicate how strikingly the fisheries could profit from an integrated research program in a number of fields. The scientific and commercial control of fishery resources and the optimum economic utilization of their food products, will largely depend on a wide range of investigations which the fisheries alone could not afford, but the urgent need demands that the experience gained in many related fields of research should be applied to fisheries more quickly and effectively than has hitherto been found practicable.

The problem is how to co-ordinate the approach to research activities to ensure, on the one hand, that the results achieved in general and related fields of research shall be interpreted and transmitted promptly to the fisheries, and on the other, that the specialized investigation of problems peculiar to fisheries shall be promoted and realistically timed. For example, in a primitive fishery based on relatively unknown, but ostensibly abundant, stocks, it does not appear very profitable to concentrate on conservation problems nor on the study of commercially unimportant species. The same fishery, however, might profit immeasurably from the introduction of a particular food processing or handling technique, a new fishing device, or a refinement of research practice whereby the fish stocks could be computed and appraised more rapidly. These anomalies, which are unfortunately common in the budgeting and conduct of fishery research programs, are unlikely to disappear without closer co-ordination than now exists of the many and various research activities at both national and international level.

3.7 *Deficiences in Knowledge and Skill*

Probably the basic item with which to break the vicious circle is knowledge, and skill in its application. Given this, the energetic fisherman will be able to begin for himself the fundamental changes required in his situation. For this reason the greatest importance attaches to technical instruction projects. Such measures must be directed not only at the fishermen but also at operatives in other phases of the industry and to the government officials on whom rests the responsibility of formulating, guiding and assisting the industry.

3.8 *Inadequate Planning for Fishery Developments*

It is not surprising that the special risks inherent in fishery undertakings, measured as they must be against a background where poverty and social backwardness perpetuate each other, have tended to frustate fishery policies in the underdeveloped areas. Lack of co-ordination, and possibly unfamiliarity with the wide range of problems requiring simultaneous attention, have too often resulted in isolated

schemes which have been too optimistic, too remote from indigenous experience, and have "foundered on the hump of operational cost." Preoccupation with consumer needs may have obscured the fundamental need to indemnify the fishing population against economic failure and to offer them the incentive of increased social and economic well-being. It may also have distracted attention from the physical capacity to absorb increased production at equitable prices. Experience so far has shown that development has proceeded fastest when founded on existing industry with the active support of the operatives in all sections. This support is not likely to be forthcoming for projects which appear to have no immediate effect upon the working lives of the operatives. One of the main difficulties is that of developing an integrated fisheries policy which will ensure that improvement and reform proceed uniformly in all sections with the direct participation of the fishing population. Such a policy must be governed by appraisals in a field in which comparatively few comprehensive economic analyses have been made, where the data are unreliable and uncertain, and where conflicting interests in different sectors challenge political expediency. This is a serious problem for small and often inexperienced fishery administrations, which on the whole tend to avoid the structural reorganization which might be necessary if increased catches are to be utilized by means of superior methods of marketing and processing, so as to encourage the fishermen and attract the consumer.

Conclusion

The foregoing analysis leads into a series of conclusions on which any efforts to increase the world's fish food production should be based. They may be summarized as follows:

1. World aquatic resources could yield food supplies to man in quantities much greater than those taken at present.

2. The increased yields would consist primarily of the kinds of organisms which are taken at present, but types of organisms other than those which bulk largely in current catches could become important.

3. The immediately predictable increases could be obtained by the employment of existing types of equipment and techniques with, in some cases, refinements of kinds already in at least experimental stages.

4. It can be imagined that some entirely novel changes in technique, amounting to intervention in basic productivity cycles of the waters, and to development of animal husbandry regarding the fish stocks and agriculture in respect of the plant resources, could be evolved out of current technical advances in other fields.

5. There seems to be no reason, therefore, to suppose that there exists any technical factor which would prevent achievement of the increased production.

6. On the other hand there are various economic and organizational factors which obviously at present operate to hinder the technical developments required.

7. The fisheries in general support relatively small industries which in many cases are not integrated with the over-all economy on whose development their own prosperity depends.

8. Present levels and patterns of demand are unfavorable to heavier production. On the one hand, high purchasing power permits discrimination in favor of other foodstuffs, while on the other, consumer incomes are too low to support the price structures on which heavier investment in primary production depends.

9. There is a widespread lack of the administrative and commercial acumen required for the successful organization of fishery industries.

10. The financial risks represented by fluctuations in supply and demand have severely restricted the flow of capital to the fisheries, while in many of the industries themselves the accumulation of earnings is insufficient to finance further expansion.

11. Restrictions enforced on international trade as a result of payment problems or protection of domestic markets operate to the serious disadvantage of fishery products. Furthermore, there has been little attempt so far to overcome the problems of distance and demand so as to make surplus supplies from one region available to needy markets in another.

12. Research investigations in support of fisheries have not yet developed sufficient knowledge of the resources to permit confident predictions and effective management. Technological research has usually been applied late and tends not to be influenced by technical problems in the fisheries.

13. The technical education of workers in all sections of the fisheries is far behind present needs in many countries.

14. Fishery policies in general tend to be frustrated by the difficulty of promoting co-ordinated development in different sections of the industry and the problem is particularly acute in the case of small and inexperienced administrations.

BIBLIOGRAPHY

(1) Food and Agriculture Organization of the United Nations. 1952 *Second World Food Survey*, Rome, Italy, p. 30.

(2) _____. *Report of the 6th Session of the Conference.* 19 November 1952 to 6 December 1951, Rome, Italy, pp. 86-87.

(3) _____. *See* (1) pp. 54-57, 21.

(4) 1953 *Yearbook of Fisheries Statistics*, 1950-51, Rome, Italy, p. 3.

(5) United Kingdom, Scottish Home Department. *Report of the* 1944 *Committee on the Herring Industry.* London, p. 16.

(6) Sverdrup, H.U. Some Aspects of the Primary Productivity of the 1952 Sea. *FAO Fisheries Bulletin* (FAO, Rome, Italy), Vol. 5, No. 6, pp. 215-23.

(7) Edmondson, W. T. and Edmondson, Yvette H. Measurements of 1947 Production in Fertilized Salt-water. *Journal of Marine Research* (Sears Foundation for Marine Research, Bingham Oceanographic Laboratory, Yale University, New Haven, Conn., U.S.A.), Vol. 6, No. 3, pp. 228-46.

Raymont, J.E.G. A Fish Farming Experiment in Scottish Sea Lochs. 1947 *Ibid.*, pp. 219-27.

(8) Woodward, F.H. Seaweeds — A Source of Chemicals and Food. 1952 *World Crops* (Leonard Hill Ltd., 9, Eden St., London), Vol. 4, No. 12, December 1952, p. 403-7.

(9) Graham, Michael. Research for Plenty — No. 7, How Much is 1953 Left in the Sea Larder ? *Agriculture* (Ministry of Agriculture and Fisheries, London), Vol. 60, No. 2, May 1953, pp. 51-55.

(10) Discovery Reports (Cambridge).

(11) Van Veen, A.G. Fish Preservation in Southeast Asia. *Advances in* 1953 *Food Research* (Academic Press Inc., New York), Vol. 4, pp. 209-31.

Westenberg, J. Fishery Products of Indo China. A Compilation of 1951 Literature up to the Japanese Invasion. *Indo-Pacific Fisheries Council Proceedings* (Bangkok, Thailand), 2nd Meeting, Section II, pp. 125-50.

(12) Kask, J.L. Statement in Proceedings of the United Nations Scien- 1951 tific Conference on the Conservation and Utilization of Resources. Vol. 7, Wildlife and Fish Resources. United Nations Department of Economic Affairs, New York, p. 63.

(13) Food and Agriculture Organization of the United Nations. 1952 Status of the Fishery Industries of the Indo-Pacific Region during the Period 1951-1952. *Indo-Pacific Fisheries Council Proceedings*, 4th Meeting, Section I, p. 40.

(14) _____. *Herring and Allied Species 1920-48.* A Commodity Study, 1949 First Progress Report. Washington, D.C., U.S.A. Mimeo.

(15) California Department of Fish and Game, Marine Research 1952 Committee. California Cooperative Sardine Research Program, Progress Report, 1 January 1951 to 30 June 1952.

Clark, Frances N. and Daugherty, Anita E. Average Lunar
1950 Month Catch by California Sardine Fishermen 1932-33 through 1948-49. *Fish Bulletin*, No. 76. California Division of Fish and Game, Bureau of Marine Fisheries, Sacramento, California, U.S.A.

Furnestin, Jean. L'application de l'océanographie à la pêche ma-
1952 ritime au Maroc. Extrait du *Bulletin économique et social du Maroc*, Vol. 15, No. 55, 3rd term, 1952.

(16) Nair, R.V. and Chidambaram, K. A Review of the Indian Oil
1951 Sardine Fishery. *Proceedings of the National Institute of Science of India* (Madras, India), Vol. 17, No. 1, pp. 71-85.

(17) Blegvad, H. and Løppenthin, B. Fishes of the Iranian Gulf. *Danish*
1944 *Scientific Investigations in Iran*, Part 3. Einar Munksgaard, Copenhagen, Denmark.

18) Blackburn, M. Races and Populations of the Australian Pilchard,
1951 *Sardinops neopilchardus* (Steindachner). *Australian Journal of Marine and Fresh Water Research* (Commonwealth Scientific and Industrial Research Organization, East Melbourne, Australia), Vol. 2, No. 2, p. 179-92.

(19) Fiedler, R.H. ; Jarvis, N. D. ; and Lobell, M.J. La Pesca y las
1943 Industrias Pesqueras en el Perú. Compañía Administradora del Guano, Lima, Peru.

nistry of Agriculture and Fisheries. *Sea Fisheries Research*,
1953 No. 31, London, p. 6.

21) Gertenbach, L.P.D. Commercial Marine Fishery Industries of South Africa -- Economic and Statistical Survey, 1890-1952. MS.

(22) Delsman, H.C. and Hardenberg, J.D.F. De Indische Zeevisschen
1934 en Zeevisscherij, Visser and Co., Batavia, Indonesia.

(23) Australia, Council for Scientific and Industrial Research.
1946 The Prospects for the Development of Fishing Industries in Northern Australia. Cronulla, N.S.W. Mimeo.

(24) Reuter J. Een Nieuwe Inheemsche Visscherij. Overdruk uit *Kolo-*
1940 *niale Studiën*, No. 2. Koninklijke Drukkerij de Unie, Batavia, Indonesia.

Umali, Agustin F. and Warfel, Herbert E. Reef Fishing in the
1949 Philippines. *Fishery Leaflet* 354. United States Department of the Interior. Fish and Wildlife Service, Washington 25, D.C., U.S.A.

(25) Wheeler, J.F.S. Personal communication.

(26) *See* (12), pp. 60-66.

(27) United States Department of the Interior, Fish and Wildlife Service. *Fishery Leaflets*, Nos. 297, 301, 317, 351, 376, 402. Washington 25, D.C., U.S.A.

———. *Separates*, Nos. 225, 231, 244, 270, 271. Washington 25, D.C., U.S.A.

———. *Special Scientific Report: Fisheries*, Nos. 33, 45-48. Washington 25, D.C., U.S.A.

(28) Ehrenbaum, E. The Mackerel and the Mackerel Fishery. *Rapports*
1914 *et Procès-verbaux des réunions*. Vol. 18, Special Report, pp. 1-101. Conseil permanent international pour l'exploration de la mer, Charlottenlund Slot, Denmark.

Steven, G.A. Contribution to the Biology of the Mackerel, I and II.
1948 *Journal of the Marine Biological Association of the United*
1949 *Kingdom* (London), Vol. 27, No. 3, pp. 517-39; Vol. 28, No. 3, pp. 555-81.

(29) *See* (12), p. 60.

(30) Barraclough, W. E. Measures of Abundance in Dog-fish (*Squalus*
1948 *suckleyi*). *Transactions of the Royal Society of Canada* (Ottawa, Ontario, Canada). Vol. 42, Ser. 3, Sect. 5, pp. 37-43.

(31) Marshall, N.B. Recent Biological Investigations in the Red Sea.
1952 *Endeavour* (Imperial Chemical Industries, London), Vol. 11, No. 43, July 1952.

(32) Anderson, W.W., Lindner, M.J. and King, J.E. The Shrimp
1950 Fishery of the Southern United States. *Fishery Leaflet* 368. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A.

Walford, Lionel A. Notes on Shrimp Fishing Along the New Eng-
1948 land Coast. *Fishery Leaflet* 318. United States Department of the Interior, Fish and Wildlife Service, Washington 25. D.C., U.S.A.

(33) Commonwealth Director of Fisheries. First South Coast Ocean
1950 Prawn Ground Discovered. *Fisheries Newsletter* (Department of Commerce and Agriculture, Sydney, Australia), Vol. 9, No. 7, August 1950, p. 5.

(34) Springer, Steward and Bullis, Harvey R. Exploratory Shrimp
1952 Fishing in the Gulf of Mexico. 1950-51. *Fishery Leaflet* 406. United States Department of the Interior, Fish and Wildlife Service, Washington, 25 D.C., U.S.A.

(35) Commonwealth Director of Fisheries. Sources of U.S. Lobster.
1950 *Fisheries Newsletter* (Department of Commerce and Agriculture, Sydney, Australia), Vol. 9, No. 1, February 1950, p. 15.

See also (21).

(36) Sheard, K. The Marine Crayfishes (spiny lobsters), family Pali-
1949 nuridae, of Western Australia, with Particular Reference to the Fishery on the Western Australian Crayfish, (*Panulirus longipes*) *Bulletin* No. 247. Commonwealth Scientific and Industrial Research Organization, East Melbourne, Australia.

(37) Bjerkan, P. Die Fischerei der Tiefseegarnelen in Norwegen und
1939 der Schutz der Kleingarnelen. *Rapports et Procès-verbaux des Réunions.* Vol. 109, Part 3, pp. 121-24. Conseil permanent international pour l'exploration de la mer, Charlottenlund Slot, Denmark.

Poulsen, E.M. Investigations on the Danish Fishery for, and the
1946 Biology of, the Norway Lobster and the Deep-Sea Prawn. *Report of the Danish Biological Station,* No. 48, p. 27. Copenhagen, Denmark.

(38) Reuter, J. Bagan si Api-api. *Visserijnieuws* (Kanaalweg 1, Bata-
1949 via), Vol. 1, No. 9, pp. 5-6.

See also (22), pp. 54-59.

(39) Cushing, D.H.; Devold, Finn; Marr, John C., and Kristjonsson, H.
1952 Some Modern Methods of Fish Detection. *FAO Fisheries Bulletin* (FAO, Rome, Italy), Vol. 5, No. 3/4, May-August 1952, pp. 95-119.

(40) Kesteven, G.L. Fisheries and Weather. *FAO Fisheries Bulletin.*
1953 (FAO, Rome, Italy), Vol. 6, No. 4, July-August 1953, pp. 109-118.

(41) Meyer, P.F. Elektrizität und Fischfang. *Orion* (Verlag S. Lux, 1953 Munich, Germany), Vol. 8, No. 3/4, Part B, February 1953, pp. 91-99.

Tester, Albert L. Notes on the Response of a Tropical Fish (*Kuhlia* 1952 *sandvicensis*) to Interrupted Direct Current. *Special Scientific Report: Fisheries*, No. 91. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A., pp. 69-83.

(42) Traung, Jan-Olof. Improving the Design of Fishing Boats. *FAO* 1951 *Fisheries Bulletin* (FAO, Rome, Italy), Vol. 4, No. 1/2, January-April 1951, pp. 2-27.

(43) Hiatt, Robert W.; Naughton, John J., and Matthews, Donald C. 1953 Effects of Chemicals on a Schooling Fish, *Kuhlia sandvicensis*. Reprinted from *Biological Bulletin* (Lancaster, Pa., U.S.A.), Vol. 104, No. 1, February 1953, pp. 28-44.

(44) Ministry of Agriculture and Fisheries. *Sea Fisheries Research* 1953 *Notes*, 1952, No. 32. London, p. 7.

(45) Graham, M. Modern Theory of Exploiting a Fishery, and Applica- 1935 tion to North Sea Trawling. *Journal du Conseil* (Conseil permanent international pour l'exploration de la mer, Charlottendlund Slot. Denmark), Vol. 10, p. 264.

————. The Trawl Fisheries: A Scientific and National Problem. 1938 *Nature* (Macmillan & Co., Ltd., London), Vol. 142.

See also (20), pp. 2-3.

(46) Food and Agriculture Organization of the United Nations. 1948 *Yearbook of Fisheries Statistics*, 1947. Washington, D.C., U.S.A., p. 245.

Peterson, C.E. Fisheries of the United States and Alaska, 1952. 1953 *Fishery Leaflet* 393. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A., p. 4.

(47) Sparre, T. Small Scale Manufacture of Fish Meal. *FAO Fisheries* 1953 *Bulletin* (FAO, Rome, Italy), Vol. 6, No. 1/2, January/April 1953, pp. 1-17.

(48) Schuster, W.H.; Kesteven, G.L. and Collins, G.P.; Fish Farming and Inland Fishery Management in Rural Economy. MS.

(49) United States Department of Agriculture. Agricultural Pro- 1952 grams of the U.S. Current and Prospective: A Report to the Food and Agriculture Organization of the United Nations. Washington, D.C., U.S.A., November 1952, p. 42.

(50) Department of Fisheries. Fisheries of the U.S.S.R. *Trade News* 1953 (Ottawa, Canada), Vol. 5, No. 9, March 1953, p. 15.

(51) Neville, W.C. Outlook for Japanese Fisheries Production. *Fishery* 1953 *Information Bulletin* (National Canners Association, Washington 6, D.C., U.S.A.), 9 January 1953, pp. 8-9.

(52) Kesteven, G.L. The Socio-Economic Programme with Special 1953 Reference to Conditions in the Indo-Pacific Region. *Indo-Pacific Fisheries Council Proceedings* (Bangkok, Thailand), 4th Meeting, Section 2. In press.

(53) United Nations Department of Economic Affairs. Measures 1951 for the Economic Development of Under-Developed Countries. New York, p. 29.

CATCH OF FISH, CRUSTACEANS AND MOLLUSKS BY SPECIES GROUPS IN 18 COUNTRIES, 1938 AND 1947-52

(Round [whole] fresh weight basis)

Country and Species Groups[1]	1938	1947	1948	1949	1950	1951	1952
	Thousand metric tons						
AMERICA, NORTH							
Canada[2]							
Fresh water teleosteans	40.6	44.0	39.7	39.0	41.7	40.8	46.5
Salmon and similar spp.	86.7	79.4	72.8	73.3	90.8	95.9	72.0
Teleostean flatfishes	10.1	19.9	21.2	20.5	28.9	35.8	43.6
Cod, hake, and similar spp.	123.3	154.2	185.3	171.2	179.1	158.2	174.1
Herring and similar spp.	181.5	232.4	300.3	249.1	295.4	271.7	210.5
Tunas, true mackerels, etc.	14.0	14.7	15.2	18.7	15.5	12.8	12.7
Other marine teleosteans	6.5	4.0	7.0	8.5	5.7	8.8	9.7
Elasmobranchs	10.5	0.1	0.2	0.1	0.1	0.2	0.1
Crustaceans	14.8	15.4	17.1	18.7	21.4	21.7	21.3
Mollusks	13.0	20.6	17.6	20.7	23.2	17.5	21.4
Seaweed	0.6	11.0	4.4	5.3	5.3	6.6	9.9
Total	**501.6**	**595.5**	**680.6**	**625.3**	**707.2**	**670.2**	**621.8**
Newfoundland[3]							
Salmon and similar spp.	17.6	16.5	16.5	19.1	24.9	20.1	16.9
Teleostean flatfishes	0.6	0.9	1.8	4.1	6.9	8.5	9.3
Cod, hake, and similar spp.	239.9	245.8	213.6	223.2	205.1	196.2	224.1
Herring and similar spp.	13.0	45.9	52.4	29.0	32.0	28.5	28.6
Tunas, true mackerels, etc.	ø	1.7	1.2	0.9	1.5	1.6	2.3
Other marine teleosteans	—	1.9	3.0	8.1	10.9	17.5	14.0
Crustaceans	1.4	2.0	2.1	2.3	2.3	2.0	1.7
Mollusks	4.7	4.0	6.0	3.2	2.5	3.3	4.0
Total	**277.3**	**318.7**	**296.5**	**289.9**	**286.3**	**277.8**	**301.0**
United States[4]							
Fresh water teleosteans	61.8	77.1	71.9	75.8	65.7	69.1	73.7
Salmon and similar spp.	299.9	226.1	181.4	213.2	149.7	188.3	180.1
Teleostean flatfishes	56.5	73.0	76.2	74.8	84.8	77.1	78.0
Cod, hake, and similar spp.	189.4	161.2	178.0	190.5	185.5	195.1	190.1
Herring and similar spp.	839.7	723.5	819.7	885.0	971.6	740.2	762.9
Tunas, true mackerels, etc.	127.3	201.0	192.3	190.5	210.9	181.4	172.4
Other marine teleosteans	148.7	268.2	309.4	294.8	280.8	276.7	258.4
Elasmobranchs	6.1	17.2	15.9	15.9	9.1	3.4	2.8
Crustaceans	...	146.5	154.2	158.8	172.3	173.7	176.9
Mollusks	614.1	449.8	432.6	445.9	519.3	434.1	445.9
Miscellaneous	1.3	1.5	1.4	1.3	1.4	5.8	2.8
Total	**2 344.8**	**2 345.1**	**2 433.0**	**2 546.5**	**2 652.1**	**2 344.9**	**2 343.9**
AMERICA, SOUTH							
Chile							
Teleostean flatfishes	0.2	0.3	0.3	0.3	0.4	0.5	0.4
Cod, hake, and similar spp.	4.8	21.9	23.4	31.4	33.1	42.8	64.5
Herring and similar spp.	5.5	4.3	2.3	8.1	15.0	8.6	5.0
Tunas, true mackerels, etc.	5.6	6.9	8.2	10.3	9.9	10.3	10.8
Other marine teleosteans	7.7	11.4	12.2	9.7	10.6	10.5	13.1
Elasmobranchs	0.4	0.8	1.0	0.5	0.4	0.4	0.6
Crustaceans	[5]...	0.8	1.3	1.1	1.2	1.4	1.5
Mollusks	[5]6.5	11.9	12.3	12.7	14.4	16.1	20.1
Other	[5]...	1.6	3.8	2.1	1.8	2.4	2.3
Total	**30.6**	**60.1**	**64.7**	**76.2**	**86.7**	**93.0**	**118.3**
ASIA							
Japan							
Fresh water teleosteans	11.4	30.0	7.5	10.4	17.7	31.5	30.3
Salmon and similar spp.	221.3	13.5	12.1	22.7	16.0	25.1	31.2
Teleostean flatfishes	63.1	112.5	88.8	85.1	99.1	99.4	124.2
Cod, hake, and similar spp.	194.1	187.5	162.7	159.2	152.9	211.0	225.4
Herring and similar spp.	1 127.8	558.8	408.5	658.7	735.5	852.5	947.9
Tunas, true mackerels, etc.	311.4	202.5	156.7	218.9	330.0	338.4	522.8
Other marine teleosteans	618.7	542.3	602.5	678.9	772.0	948.6	1 237.1
Elasmobranchs	65.3	75.0	90.4	118.5	101.1	85.7	88.6
Crustaceans	419.3	750.0	28.8	32.6	47,9	55.5	68.8
Mollusks	[6]...	[6]...	463.2	423.0	743.1	876.8	1 003.4
Other	[6]452.6	[8]495.0	64.4	125.3	209.3	272.1	394.4
Total	**[7]3 521.1**	**2 967.1**	**[8]2 453.8**	**[8]2 980.4**	**[8]3 793.6**	**3 796.7**	**4 674.2**

(For notes, see 196)

CATCH OF FISH, CRUSTACEANS AND MOLLUSKS BY SPECIES GROUPS IN 18 COUNTRIES
1938 AND 1947-52 (*continued*)

(Round [whole] fresh weight basis)

Country and Species Groups[1]	1938	1947	1948	1949	1950	1951	1952
	..... Thousand metric tons						
EUROPE							
Belgium[9]							
Teleostean flatfishes	9.1	12.5	11.0	12.1	16.3	14.1	13.5
Cod, hake, and similar spp.	14.3	24.1	22.8	23.5	20.5	22.2	28.4
Herring and similar spp.	7.0	33.0	24.8	19.0	12.4	9.9	15.4
Tunas, true mackerels, etc.	0.5	0.2	0.6	0.5	0.7	0.7	0.6
Other marine teleosteans	3.6	8.0	2.5	3.0	2.6	2.4	2.0
Elasmobranchs	5.2	1.3	7.4	8.0	5.7	4.7	4.7
Crustaceans	[10]3.1	[10]2.1	1.8	2.1	2.0	2.4	3.2
Mollusks	[10]...	[10]...	Ø	0.1	0.1	0.2	0.9
Total	**42.8**	**81.2**	**70.9**	**68.3**	**60.4**	**56.6**	**68.6**
Denmark[11]							
Fresh water teleosteans	0.5	0.4	0.5	0.7	0.7	0.6	0.4
Salmon and similar spp.	1.1	1.7	2.3	3.0	3.3	3.9	4.5
Teleostean flatfishes	31.0	61.0	62.5	58.8	46.0	49.0	52.8
Cod, hake, and similar spp.	25.0	55.0	58.0	66.0	54.0	50.6	112.0
Herring and similar spp.	15.0	32.0	30.2	38.0	32.0	31.0	95.2
Tunas, true mackerels, etc.	6.5	11.3	10.1	17.0	12.0	12.4	22.2
Other marine teleosteans	15.0	37.0	53.0	53.0	73.1	122.2	11.3
Elasmobranchs	0.2	4.0	2.3	3.0	2.4	2.9	3.0
Crustaceans	0.6	1.8	1.7	1.5	1.7	1.8	1.5
Mollusks	1.2	1.2	4.6	14.0	26.0	18.1	21.0
Total	**96.1**	**205.4**	**225.8**	**255.0**	**251.2**	**292.5**	**323.9**
Finland							
Fresh water teleosteans	...	17.0	17.0	25.0	25.0	25.0	25.0
Salmon and similar spp.	...	0.5	0.5	0.5	0.6	0.5	0.4
Teleostean flatfishes	...	Ø	Ø	Ø	Ø	Ø	Ø
Cod, hake, and similar spp.	...	0.1	0.1	0.1	0.1	0.1	—
Herring and similar spp.	...	21.0	21.0	30.0	30.0	30.0	22.0
Other marine teleosteans	...	7.4	7.4	10.0	10.0	10.0	10.0
Crustaceans	...	—	—	0.1	0.1	0.1	0.1
Total	**22.4**	**46.0**	**46.0**	**65.7**	**65.8**	**65.6**	**57.5**
Germany, Western[12]							
Fresh water teleosteans	26.0	0.1	2.2	1.2	0.6	0.7	0.6
Salmon and similar spp.	0.1	'	'	0.1	0.7	0.6	0.5
Teleostean flatfishes	13.0	0.4	6.6	9.9	14.2	7.4	8.5
Cod, hake, and similar spp.	411.8	133.5	194.0	223.9	188.2	187.7	185.6
Herring and similar spp.	226.5	150.3	173.0	235.0	219.2	316.8	283.7
Tunas, true mackerels, etc.	5.5	1.3	6.6	6.1	2.0	3.4	2.4
Other marine teleosteans[13]	57.0	3.3	2.6	11.1	70.1	123.3	125.1
Elasmobranchs	2.1	1.2	2.0	2.5	1.0	1.5	1.5
Crustaceans	34.4	11.2	14.2	19.2	33.1	30.9	25.2
Mollusks	3.7	0.6	12.1	1.4	6.4	7.6	11.2
Other[14]	—	—	—	2.9	19.7	Ø	18.9
Total	**779.9**	**302.0**	**413.3**	**513.2**	**555.3**	**680.0**	**663.2**
Iceland							
Salmon and similar spp.	0.6	0.4	0.1	0.2	—	—	...
Teleostean flatfishes	2.4	6.0	8.0	8.2	4.5	6.0	...
Cod, hake, and similar spp.	111.5	243.7	281.4	281.6	231.2	224.9	...
Herring and similar spp.	155.9	216.9	150.1	71.4	60.4	84.6	...
Other marine teleosteans	3.6	10.1	24.7	32.7	71.4	102.0	...
Elasmobranchs	0.1	—	0.3	0.2	0.3	0.3	...
Crustaceans and mollusks	0.2	—	—	—	—	—	...
Total	**274.3**	**477.2**	**464.7**	**394.2**	**367.8**	**417.8**	...
Ireland							
Fresh water teleosteans	0.2	0.1	0.2	0.1	0.1	0.1	0.1
Salmon and similar spp.	0.7	0.8	1.1	1.0	1.0	1.2	1.0
Teleostean flatfishes	0.8	1.1	1.1	1.0	0.9	0.9	1.2
Cod, hake, and similar spp.	2.8	5.1	5.3	5.2	4.1	3.7	5.6
Herring and similar spp.	2.9	6.8	4.2	2.8	3.5	2.8	3.0
Tunas, true mackerels, etc.	1.8	1.9	7.6	1.4	1.0	0.8	0.6
Other marine teleosteans	0.5	1.2	1.2	1.4	0.8	0.8	0.9
Elasmobranchs	0.5	1.1	1.3	1.9	2.5	2.4	4.7
Crustaceans	0.3	0.2	0.2	0.4	0.2	0.3	0.5
Mollusks	2.2	3.2	3.7	2.9	1.1	1.0	1.1
Total	**12.7**	**21.5**	**25.9**	**18.2**	**15.1**	**14.0**	**18.5**

CATCH OF FISH, CRUSTACEANS AND MOLLUSKS BY SPECIES GROUPS IN 18 COUNTRIES, 1938 AND 1947-52 (*continued*)

(Round [whole] fresh weight basis)

Country and Species Groups[1]	1938	1947	1948	1949	1950	1951	1952
	..... Thousand metric tons						
EUROPE (*continued*)							
Italy							
Fresh water teleosteans.....	27.5	21.0	20.0	20.0	20.0	10.0	10.0
Herring and similar spp.[15] ..	60.0	50.5	43.3	61.3	60.8	65.1	84.6
Tunas, true mackerels, etc.[15]	3.2	2.5	1.4	2.7	2.2	2.9	2.4
Other marine teleosteans[16]...	69.5	69.8	66.7	60.1	65.4	77.8	86.3
Crustaceans	6.0	3.1	3.9	4.9	6.4	6.3	5.8
Mollusks.....	15.0	17.6	18.4	16.7	20.4	22.5	23.0
Other[17]	14.0	17.5	16.7	14.3	15.0	...	...
Total	**195.2**	**182.0**	**170.3**	**180.0**	**190.2**	**184.6**	**212.1**
Netherlands							
Fresh water teleosteans.....	20.3	11.3	12.4	13.0	17.9	16.2	15.3
Teleostean flatfishes	15.1	18.2	24.7	21.0	24.0	23.9	23.7
Cod, hake, and similar spp...	21.6	26.1	13.6	16.8	19.1	20.7	22.3
Herring and similar spp.....	118.4	155.5	164.8	131.8	137.2	150.0	162.8
Tunas, true mackerels, etc...	6.9	1.6	5.5	7.1	6.6	10.6	11.4
Other marine teleosteans....	0.8	0.8	1.5	1.5	1.5	2.2	3.4
Elasmobranchs	0.3	0.1	0.5	0.5	0.3	0.3	0.4
Crustaceans[18]	3.0	11.5	8.0	7.7	10.0	13.1	13.0
Mollusks.....	42.4	53.6	50.0	50.0	27.4	43.0	46.0
Total	**228.8**	**278.7**	**281.0**	**294.4**	**244.0**	**280.0**	**298.3**
Norway							
Fresh water teleosteans.....	0.5	0.3	0.3	0.2	0.3	0.3	0.3
Salmon and similar spp.....	1.2	1.4	1.6	5.0	4.7	r10.9	10.2
Teleostean flatfishes	7.3	9.6	10.0	8.8	11.4	r11.0	9.2
Cod, hake, and similar spp...	426.5	514.7	398.6	385.8	425.7	r500.8	459.2
Herring and similar spp.....	662.5	598.1	963.9	731.0	895.7	r1 204.6	1 210.7
Tunas, true mackerels, etc...	7.7	14.8	13.5	16.9	12.4	r24.8	33.2
Other marine teleosteans....	2.5	4.7	5.0	5.5	8.7	r9.0	7.6
Elasmobranchs	37.0	40.7	98.1	131.4	101.1	r62.1	54.4
Crustaceans	7.0	9.6	10.1	11.7	6.0	7.5	6.5
Mollusks.....	0.4	0.7	0.4	0.2	0.2	r0.1	0.1
Seaweed and kelp	ø	1.6	2.5	0.7	1.4	r7.4	7.4
Total	**1 152.6**	**1 196.1**	**1 504.0**	**1 297.3**	**1 467.7**	**r1 838.5**	**1 798.8**
Portugal[19]							
Fresh water teleosteans.....	0.8	0.7	0.6	0.5	0.4	0.6	0.3
Teleostean flatfishes	0.8	0.3	0.4	0.4	0.4	0.4	0.5
Cod, hake, and similar spp...	46.4	93.3	100.6	122.8	137.7	133.6	147.7
Herring and similar spp.....	120.1	106.2	79.4	63.4	86.7	81.6	96.0
Tunas, true mackerels, etc...	3.7	5.3	4.6	10.2	5.6	9.1	12.1
Other marine teleosteans....	49.0	60.5	72.2	68.5	67.0	74.1	71.7
Elasmobranchs	2.9	3.9	4.3	4.1	3.1	2.3	2.3
Crustaceans	12.7	7.1	6.5	7.3	3.3	2.0	2.4
Mollusks.....	2.9	4.2	4.7	3.9	3.0	3.7	4.2
Total	**239.3**	**281.5**	**273.2**	**281.2**	**307.3**	**307.5**	**337.2**
Spain							
Teleostean flatfishes	...	5.4	5.4	5.7	5.4	5.2	5.2
Cod, hake, and similar spp...	...	162.0	145.1	139.7	165.2	183.6	212.7
Herring and similar spp	...	133.7	127.2	110.5	115.8	130.9	137.5
Tunas, true mackerels, etc...	...	40.6	37.6	49.7	55.2	46.6	38.7
Other marine teleosteans....	...	178.5	171.2	185.7	177.0	172.7	186.7
Elasmobranchs	...	10.4	10.5	10.6	10.8	11.6	0.6
Crustaceans	...	18.4	15.6	17.5	15.4	21.4	18.6
Mollusks.....	...	23.4	21.8	31.6	31.8	20.2	32.5
Total	**229.1**	**572.4**	**1 534.2**	**551.0**	**576.5**	**592.2**	**632.5**

CATCH OF FISH, CRUSTACEANS AND MOLLUSKS BY SPECIES GROUPS IN 18 COUNTRIES 1938 AND 1947-52 (*continued*)

(Round [whole] fresh weight basis)

Country and Species Groups	1938	1947	1948	1949	1950	1951	1952
	..... Thousand metric tons						
EUROPE (*concluded*)							
Sweden [20]							
Fresh water teleosteans[21] ...	15.7	15.8	15.8	15.8	15.8	15.8	15.8
Salmon and similar spp.....	0.7	2.0	1.9	2.0	2.3	2.0	1.7
Teleostean flatfishes	5.4	6.2	5.9	5.2	4.9	4.8	5.2
Cod, hake, and similar spp...	32.0	56.9	59.3	56.8	54.3	48.2	55.4
Herring and similar spp.....	76.7	82.7	107.3	101.7	104.5	106.8	126.3
Tunas, true mackerels, etc[22] .	4.7	6.8	8.4	9.6	13.5	12.0	13.3
Other marine teleosteans[22] ..	6.5	6.5	7.2	8.4	5.7	8.1	8.5
Crustaceans and mollusks....	1.8	1.9	2.1	2.7	2.3	2.3	2.7
Total	**143.5**	**178.8**	**207.8**	**202.2**	**203.3**	**200.0**	**228.9**
United Kingdom							
Salmon and similar spp.....	...	1.0	1.9	2.0	2.0	2.0	...
Teleostean flatfishes	64.7	108.5	74.7	71.7	69.6	64.5	...
Cod, hake, and similar spp...	735.3	760 0	740.7	764.3	639.5	733.8	...
Herring and similar spp.....	284.4	232.0	277.4	213.2	188.2	179.6	...
Tunas, true mackerels, etc...	10.2	3.7	8.2	6.9	4.2	6.3	...
Other marine teleosteans....	37.7	11.0	42.9	41.6	30.2	37.7	...
Elasmobranchs	33.5	7.5	33.1	35.5	32.3	35.7	...
Crustaceans	[23]...	[23]...	8.4	7.6	6.3	7.4	...
Mollusks.....	[23]31.4	[23]25.8	18.5	15.8	16.2	18.8	...
Total	**1 197.1**	**1 149.6**	**1 205.7**	**1 158.7**	**988.5**	**1 085.8**	...

Source : Official communications from the countries concerned.

Note : As this table is based on the round (whole) fresh weight of the catches the data do not necessarily correspond to figures giving the landings on a landed weight basis. Due to rounding off to the nearest 100 metric tons, the totals do not necessarily correspond to the actual aggregate of the components.

r) Revised data which differ from the figures published in Table 3 of the FAO *Yearbook of Fisheries Statistics*, 1950-51.

[1]For a definition of the species included under each of these groups, see the FAO *Yearbook of Fisheries Statistics*, 1950-51, p. 279. Sturgeons and other ganoids are included with fresh water teleosteans. For the purpose of the table the species group "Other marine teleosteans" includes also : (*a*) barracudas, mullets and similar species ; (*b*) jacks, pompanos and similar species ; (*c*) perches, croakers, breams and similar species. — [2]1938 and 1947-52 Canada excludes Newfoundland. — [3]1947-48 based entirely on Newfoundland exports plus estimated quantities for domestic consumption. — [4]1938, 1947-52 United States of America includes Alaska. — [5]1938, "Mollusks" include "Crustaceans" and "Other". — [6]1938 and 1947, "Other" includes "Mollusks". — [7]Includes an additional 36,100 tons not available by species. — [8]Includes an estimated 368,100 tons of unreported landings in 1948, 447,100 in 1949 and 569,000 tons in 1950. — [9]May include landings by foreign fishing craft, 1938 ; includes Belgian landings in foreign ports 1948-51. — [10]1938 and 1947, "Crustaceans" includes "Mollusks". — [11]Excludes the Faeroes and Greenland. — [12]Western Germany ; total estimate for Eastern Germany is 50,000 tons annually. [13]Includes catches and fodder fish, not available by species: 1938, 51,900 tons ; 1948, 1,200 tons ; 1949, 1,000 tons, and 1950, 500 tons : unsold and confiscated fish : 1947, 400 tons ; 1948, 900 tons ; and 1949, 9,900 tons ; and additional and different species : 1951, 24,200 tons. — [14]Unsold and confiscated fish and other products and aquatic mammals, 1950 ; and dolphin, 1951. — [15]Mackerel included with herring and similar species. — [16]Includes quantities of frozen fish caught in the Atlantic by trawlers and landed in Italy, not available by species (1938, 13,500 tons ; 1949, 2,500 tons ; 1950, 5,500 tons , and 1951, 3,400 tons). — [17]Includes elasmobranchs. — [18]Immature shrimp in 1938 and immature fish in 1938 and 1947-48 included with fresh water teleosteans. — [19]Includes Azores and Madeira. — [20]Includes catch landed in foreign ports. — [21]Includes an estimated quantity of 14,000 tons caught in lakes and rivers. — [22]Tuna included with other marine teleosteans. — [23]1938 and 1947, "Mollusks" include "Crustaceans".

FISH MARKETING IN EAST PAKISTAN

East Pakistan has a relatively large fish production deriving from marine, brackish and fresh water operations consisting mainly in :

1. capture operations in the foreshore waters of the delta and Chittagong coasts ;
2. capture operations in the brackish waters of the rivers and other open waterways of the delta region ;
3. trapping ponds in the bheris of the delta region ;
4. capture operations in the inland rivers and open waterways ;
5. trapping ponds in the inland bheels ;
6. culture operations in the inland tanks.

These operations are estimated to produce at least 250,000 tons annually of which the principal species are Indian carps, snakeheads and catfish in the fresh water fisheries ; hilsa, mullets and lates in the brackish water fisheries ; and perches, Bombay duck, pomfrets, etc., in the marine fisheries.

Although a supply of cheap protein food is essential to the needs of the East Pakistan population of some 48 million, and although fish is a traditional and integral part of the daily diet, the benefits of this production are not fully realized owing to the lack of properly organized marketing and distribution. There is a great deal of subsistence fishing and a great deal of unprofitable commercial fishing both of which could, under better marketing conditions, be developed to serve the predominantly rural population over a much wider area. The deltaic conditions provide a vast natural network of water highways, but water transport is very inadequately used for the distribution of fish supplies.

The Government of East Pakistan requested assistance under the FAO Expanded Technical Assistance Program (ETAP) and accordingly an FAO/ETAP team, comprising a commercial fisheries consultant and a fish harbor specialist, was assigned to the country for the period October 1952 to January 1953, to survey the situation and to advise on the necessary measures of improvement.[1] Their special concern was the need for organizing the landing, transport, handling and marketing facilities. The commercial fisheries consultant, Nils Jangaard, of Norway, concentrated on the economic considerations affecting the distribution and marketing of supplies including the nature, quality and volume of the latter in relation to consumer needs, the transport and marketing facilities and the strategic organization of services whereby the wider, speedier and more profitable

[1] *See* also *FAO Fisheries Bulletin*, V. (1), 29 ; V. (3/4), 157 ; V.(5), 205 ; VI. (3), 95 ; VI. (4), 145.

distribution of supplies could be secured. The fish harbor specialist, Harald Fibiger, of Denmark, devoted his attention to the technological problems affecting the operation of landing, transport and handling services including the availability of natural harbors or havens, the location and construction of berthing accommodation, the types of craft already in use or which could be used for fish transport, and those which might need to be introduced, suitable both for fish cargoes and navigation along the natural waterways of the area.

Figure 3. A typical example of the methods by, and the conditions under which fish are handled and marketed in East Pakistan. The photograph shows the mats on which they are set out for display and the baskets and other containers in which they are transported.

The experts traveled extensively along the water systems of East Pakistan observing the taking, landing and sale of fish and the fish marketing organization in different parts of the country. They held detailed discussions with the Directorate of Fisheries and other public officials, the representatives of commercial transport undertakings, fishermen, fishermen's co-operatives, fish merchants, dealers and others engaged in, or interested in, the fishing industry.

They quickly found ample justification for the government's request and that some improvement in the transport and disposal of catches, rather than inadequate fishing capacity, was the most pressing of the various problems requiring solution if the potential fisheries resources were to be exploited to the best advantage. Some

fishing centers are quite close to markets and to regular transport services, but even here there are the problems of inadequate handling and packing, unfavorable traffic schedules and poor commercial organization. Many other fishing centers, however, are scattered and remote from both markets and transport services and the fishermen find only restricted outlets for the catches.

In all areas the grave inadequacy of commercial organization and training amongst the fishermen and fish merchants constitutes a major obstacle to the growth of a wider and more efficient system of distribution. Individual operatives have neither the resourcefulness nor the standing to bring about spontaneously the comparatively simple changes which the experts considered to be necessary and which will, therefore, require guidance and support from the Government in the early stages.

It was felt that much could be done to relieve this situation by making better use of the regular rail and steamship services and by introducing suitable carrier vessels to link the fishing centers with the main channels of distribution. This problem was particularly acute in the Khulna area where the withdrawal of the merchants following the cessation of trade with Calcutta has caused considerable distress among the fishermen. This situation could be greatly relieved by the provision of a water-borne carrier service linking the area with the busy urban market of Khulna town.

Throughout the inland and estuarine areas generally fish marketing is impeded by the absence of well-chosen collection centers where the fishermen could land their catches more regularly and expeditiously. Landing stages are needed with some provision for packing and for protecting catches against the sun. Where tidal fluctuations are great, pontoons could provide the necessary berthing accommodation and could be moved to follow the seasonal concentrations of fishing. There is equally wide scope for improvements in the wholesale and retail distribution of catches. Adequate cleansing routines, small ice-making plants, better boxes, elevated stalls, clean mats, more shelter, etc., could all help to improve the condition of the fish as sold and, coupled with more co-ordinated transport, could undoubtedly extend the area and intensity of distribution to the mutual advantage of fishermen, merchants and consumers.

Along the coast the problems are not quite so urgent and a fairly profitable trade has been developed in dried fish which meets the keen demand in Chittagong. The catches are taken off Dubla and Sonadia Islands, dried on shore and transported thence in sampans. Even so there is room for improvement in the drying techniques and the strength of demand would probably repay any improvements in quality.

The Government has an active Directorate of Fisheries with field staff working in the various fishing districts. A number of schemes have been promoted or are under consideration, some of which could help to give effect to the recommendations of the FAO/ETAP team. Undoubtedly a great many problems remain to be tackled in order

to promote a healthy, confident and enterprising fishing industry, but there is plenty of evidence that a number of relatively modest reforms could bring about an early and appreciable improvement.

Whatever the deterrents may be, the country possesses certain special advantages in the way of a large fishing population, a traditional habit of fish consumption, and potentially large resources which might be developed in marine, river and impounded water areas and in over 8 million hectares of wet paddy fields.

NEW FISH HARBOR PLANNED FOR KARACHI, PAKISTAN

At the request of the Government of Pakistan, two FAO experts, Hubertus van Pel and A. van den Berg, both of the Netherlands, spent three months in Karachi to survey the location for a new fish harbor and draw up detailed estimates and plans for its construction.[1] This fish harbor is to replace the present primitive and unsatisfactory facilities at Juna Bandar situated some four miles from the mouth of the harbor, which requires the fishing boats to sail against prevailing winds and strong tidal currents and from four to five extra hours of transport. The fish are often of poor quality on arrival, as little or no ice is used. The present harbor has no berthing facilities only stepped wharves, and has no possibilities for extension to accommodate auxiliary fishing industries. It can accommodate a maximum of 120 vessels against a current need of berthing space for 220 vessels. Furthermore, it is remote from the fish market as well as from the ice-making plants.

The new harbor will be located only one mile from the open sea. The site will allow future expansion both for the fish harbor and for auxiliary fisheries industries, and connection with Karachi by road, rail and tramway can be provided without difficulty.

To determine the best of four possible sites, data on prevalent winds, tides, currents and silting were collected and analyzed and an estimate made of the number of fishing vessels operating out of Karachi and nearby villages. It is assumed that out of about 1,000 fishing craft of all sizes, about 700 will be making use of the new harbor, amounting to 300 daily arrivals. Present landing statistics were analyzed and it was estimated that, with the improved harbor facilities, some 8,160 tons of fresh fish and 7,500 tons of wet, salted fish will be landed in the first year, increasing simultaneously with growing motorization of the fishing fleet and introduction of fish carrier boats, to some 30,000 tons in all, after five years.

The new harbor will consist of an outer basin to reduce swell and an inner basin with all berthing, handling and servicing facilities : berthing, along one side, for 306 landings per day, and servicing along the other side, to avoid congestion and traffic difficulties.

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[1] *See* also *FAO Fisheries Bulletin*, IV. (4), 37 ; IV. (5), 42 ; IV. (6), 24 ; V. (2), 62.

The plans provide for a market building, 468 feet long, with adequate floor space for peak season sales, a fishermen's rest room, restaurant, administration offices, lavatories, First Aid and police stations and a loading base. Further facilities include an ice-making plant of 15 tons per day and two cold stores for up to 15 tons of ice at 27°F. and 15 tons of fresh fish at 30°F., slip-ways, workshops, net drying grounds, stores for nets, gear, salt, etc. Water and electric power will be supplied to the harbor area. Additional grounds are set apart for further industries such as a cannery (sardine), fish meal and oil plant, fish drying yards, and for the possible development of a housing site for fishermen.

The survey report includes recommendations for the administration and management of the fish harbor, estimates of operating expenses and detailed estimates of the economic and financial aspects of the whole project. A series of detailed plans were prepared as part of the survey.

MARINE FISHERIES RESOURCES OF CHILE

Hake Biology

Dr. Eric M. Poulsen, formerly of the Danish Biological Station and now Executive Secretary of the International Commission for the Northwest Atlantic Fisheries (ICNAF), spent six months during 1951/52 on an assignment under the FAO Expanded Technical Assistance Program "to organize and initiate a program of survey and assessment of the marine fishery resources of Chile, particularly in the coastal region between Valparaiso and Talcahuano."[1] In the course of his assignment Dr. Poulsen carried out extensive field work as a result of which he was able to gather much information on the biology of various commercially important species of fish, especially of hake (merluza). His report on this work presents an interesting summary of the present knowledge of these species, besides presenting a plan for further work to be carried out by the Government of Chile in extending this enquiry into the nature and extent of its marine resources.

His work on hake brought the following results:

1. Two species of hake occur in Chilean waters — *M. gayi* off the coast from Coquimbo to Valdivia (possibly further south) and *M. australis* in the Puerto Montt area (possibly also further north and south). *M. gayi* is indicated by the name of hake (merluza) whereas *M. australis* is indicated by the name of southern hake (southern merluza).

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[1] *See* also *FAO Fisheries Bulletin*, IV. (4), 36 ; IV. (6), 23-24 ; V. (1), 28 ; V. (2), 57 65 ; V. (3/4), 157 ; V. (5), 205 ; V. (6), 229 ; VI. (1/2), 47 ; VI. (3), 94 ; VI. (4), 143

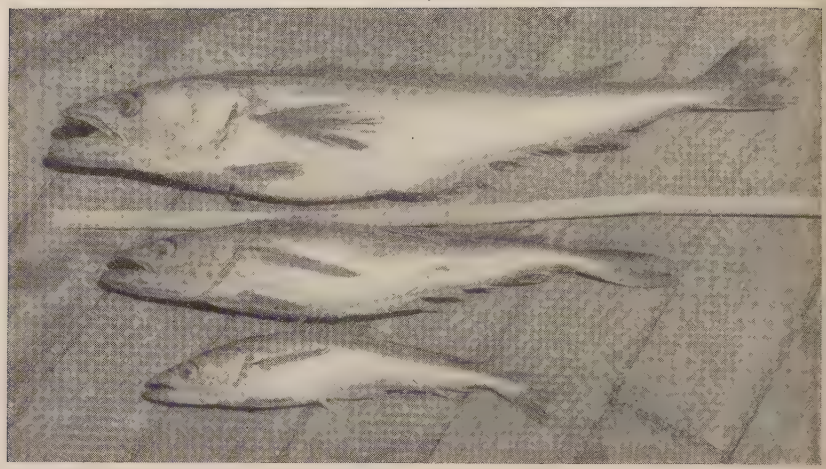

Figure 4. A two, a three, and a more than four-year-old hake taken from Chilean waters and measured by Dr. Poulsen during the course of the FAO project there.

M. gayi was found to have a higher gill raker count than *M. australis*. The information which follows relates to *M. gayi*.

2. On the evidence of catch records it would appear that the greatest concentrations of hake occur in the Pichilemu-Llico and Talcahuano areas, and that the species tends to live in greatest abundance in depths between 167 and 330 feet.

3. No individuals below $9\,^{7}/_{8}$ in. were found mature or preparing to spawn. All individuals of a length of 19 in. or more were either preparing to spawn, spawning or had spawned. The length upon attaining maturity for the first time differs to some degree along the coast from south to north, the length being somewhat greater in the south than in the north. Fifty percent of the specimens were found to be mature at a length of $14\,^{5}/_{8}$ in. in the Concepción Bay area; farther north in the San Antonio-Llico area at 13 in.; and in the northernmost area, Valparaiso-Quintero even at so short a length as $11\,^{7}/_{8}$ in. This probably results from a faster growth rate in the south than in the north.

The males attain maturity for the first time at a length considerably smaller than the females. In the Valparaiso-Papudo area we thus find mature males down to a length of only $9\,^{7}/_{8}$ in. and at, say, $11\,^{3}/_{8}$ in. more than half the males are mature. In Concepción Bay, mature males are found down to a length of $13\,^{7}/_{8}$ in. only, and at $14\,^{1}/_{4}$ in. more than half the males are mature.

Of the females the smallest mature ones are 12 1/4 in. in the Valparaiso area, and at a size of 13 7/8 in. more than half are mature. In Concepción Bay, mature females are found down to 15 in. and at 15 3/4 in. more than half are mature. The survey showed :

	Concepción Bay	Valparaiso-Papudo Area
Smallest mature males . .	13 7/8 in.	9 7/8 in.
Smallest mature females .	15 in.	12 1/4 in.
More than half the males mature at.	14 1/4 in.	11 3/8 in.
More than half the females mature at.	15 3/4 in.	13 7/8 in.

This difference is not due to a slower growth rate of the males, but to the fact that the males become mature at a somewhat earlier age.

The spawning season is from October to April (May) with the two maxima, a bigger one in November-December and a smaller one in April-May.

Spawning grounds were found at depths between 164 and 492 feet, but probably spawning occurs also over greater depths.

4. Age was determined by the methods of measurements and by reading otoliths ; the two methods gave the following results :

Age	By Measurements	From Atoliths
1 year	6 5/16 in.	7 9/16 in.
2 year	10 5/8 in.	10 13/16 in.
3 year	15 in.	15 3/4 in.
4 year	18 1/2 in.	17 5/16 in.

and it was concluded that the measurement method could be used for determination of age and growth. Extensive work along these lines gave an indication that there were differences in growth rate between areas, thus :

Area	1st Year	2nd Year	3rd Year
Concepción Bay	7 7/8 in.	13 in.	*ca.* 17 3/4 in.
Pichilemu-Llico	8 11/16 in.	13 in.	*ca.* 15 in.
San Antonio	9 1/2 in.	11 7/8 in.	15 in.
Valparaiso	7 1/6 in.	11 in.	14 5/8 in.
Quintero	7 1/2 in.	11 in.	*ca.* 14 5/8 in.

5. Investigations were made of distribution of the fish according to size, for which purpose studies were made of the Valparaiso-Quintero area and Concepción Bay and, since

this bay has no depths greater than *ca.* 330 feet the Pichilemu area nearby with deeper water was included in the comparison. In both the investigated areas, the smaller individuals up to a size of about 10 5/8 in. are found most abundantly in the deeper zones ; the quite small ones, 2 1/2 to 6 1/4 in. have *only* been found at depths greater than 300 feet. In the inner part of Concepción Bay, where trawling for hake has been carried out in shallow water, 60 to 115 feet, no hake below 10 5/8 in. was caught and even of the size and group 11 to 15 in. the catch was very small, only 3 percent.

The only catch that has yielded quite small hake, 2 3/8 to 4 in., only a few months old, was made in the deepest water fished, i.e. 460 to 500 feet off Valparaiso. That the youngest bottom stages occur in deeper water can only be explained if the larvae occur mainly over these deeper waters ; that the young fish first seek the bottom out in this deep water ; and only later on during the coming years do they migrate to shallower water, nearer the coast.

6. The hake undertake considerable migrations — regional from coastal to deeper waters and *vice versa*, partly in connection with the spawning and partly connected with age ; and diurnal vertically from the bottom to intermediary water layers and *vice versa*.

7. The food consists not of true bottom animals, but of animals living near the bottom or in free water.

REPORT ON THE FISH CANNING INDUSTRY IN YUGOSLAVIA

An FAO fish canning specialist, R. Vesterhus, of Norway, recently spent four months in Yugoslavia to study the fish canneries, their equipment and operating methods and the quality of the canned fisheries products.[1] His observations and recommendations should be of general interest, particularly in countries which experience similar difficulties in their fish canning industries.

It was found that in order to ensure the best possible quality of raw material, especially for sardine canning, additional facilities for ice manufacturing at the fishing ports are required, as well as improved methods of icing, chilling, transporting and holding fish in the boats and in the canneries. The compulsory use of retorts for processing of canned fish is recommended, together with thorough training of retort operators and the issuing of detailed instruction for safe retorting. Similarly, the operators of can-seaming machines require more thorough training in the proper operation, adjustment

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[1] *See* also *FAO Fisheries Bulletin*, V. (3/4), 157 ; V. (5), 206 ; VI. (3), 95.

and maintenance of the machines and the routine inspection of can seams. Improvements in the manufacture of tin cans by means of the most modern can-making machinery are suggested as well as the increased use of drawn tins. Vesterhus also looked into the problems of using aluminum cans.

Gradual improvements through modernization and mechanization of the canning plants and the canning operations are suggested to cut down on production costs and to ensure uniform high quality of the products so that the industry may be able to compete with that of other countries.

The establishment of a quality control laboratory is strongly recommended to test the raw materials as well as the finished products, especially those to be exported. The laboratory should also be the source of technical advisory services to the industry, in connection with the planning of new canneries, rationalization of plant operation, operating difficulties and faulty products; it could also serve as a training center for cannery personnel.

SURVEY OF THE SPONGE FISHERIES OF LIBYA

C.D. Serbetis, Inspector in the Fisheries Bureau of the Greek Ministry of Economy, and Director of the Fisheries Laboratory of Greece, spent three months in 1951 surveying the sponge fisheries of Libya on behalf of FAO and the Government of Libya.[1]

In his survey Serbetis gathered information on the location and nature of the sponge areas and the conditions affecting their productivity; he also collected detailed information on the fishing operations, their methods, organization, hazards, trade and administration.

His account of the sponge grounds reports in detail the location of each area in which the sponges occur in quantities sufficient to support profitable operations. He concludes that there are exploitable sponge grounds all along the Libyan coasts from the shore out to depths of 110 yards and sometimes deeper. Sponges abound on the rocky bottoms and on the ledges where the best quality specimens are found. They also occur on solid, silt bottoms strewn with small stones, boulders or mollusk shells, and on the "meadows" of Zostera and algae. They are not found on sand or soft ooze.

His examination of the state of the industry, including compilation of statistics, leads him to the conclusions that despite the opinion of certain sponge fishermen who for the last 50 years have not ceased to complain of the gradual depletion of the sponge grounds, statistics indicate that the quantity of sponges fished is in direct ratio to the number of boats in a season, and that present over-all production is on the whole larger than in the past. There is, however, a substantial decrease in production of the zimocca and fine Turkey cup varieties.

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1 *See* also *FAO Fisheries Bulletin* IV. (5), 42; IV. (6), 24; V. (1), 29; V. (2), 57

A marked lowering of the quality of the sponges in the last ten years is indicated. This might be attributed in part to the more careful grading which has been required by the postwar market, i.e. that the effect is in part a " marking-down " of Libyan sponges, and disappearance of two valuable species. The vast extent of the sponge grounds permits increasing production especially of inferior grade sponges.

The fishing methods include both skin and suit diving, as well as the use of rakes and hooks. Most of the divers engaged in sponge fishing are equipped with a submarine breathing apparatus (diving suit or Fernez appliance) and operate from the shore out to a depth of 230 feet ; only a few work without any special equipment. Sponge fishing in also practised with wide-mouthed rake dredges (gangava) dragged along the sea bottom at depths of 390 to 490 feet. Sponge hooks are also used from the shore shallows out to a depth of 80 feet. The diving suit and the Fernez appliances are the most complicated systems, requiring a very large capital outlay and highly experienced seamen ; they involve the loss of many divers each year. Gangava fishing requires a knowledge of navigation. Fishing from small boats with unassisted divers, and sponge hook fishing require only very elementary knowledge and a very small outlay. Moreover, in proportion to the number of men in the crew, the profit is not less than that obtained with diving equipment. It is impossible to increase this number at present, save in the case of the boats using sponge hooks. As soon as Libyan seamen have been trained, however, the number of local gangava can be increased. The wider adoption or encouragement of the machine diving system is not recommended. It is reported that Tunisia now has 4 diver-operating ships, 55 gangava fishing boats, and over 1,000 boats using sponge hooks.

On the basis of his survey of the industry Serbetis concludes that the regulations now in force are adequate but insufficiently enforced. It is necessary to maintain stricter supervision to ensure the protection of small sponges, and to raise the rate of compensation paid to divers who are victims of accidents occurring at work. Sponge cultivation is not practicable in Libya owing to the abundance of the natural sponges, and to the lack of sheltered localities ; stricter conservation of the zimocca and the fine Turkey cup sponges would be valuable.

Conferences and Meetings

Oceanographic Research Program for the Indo-Pacific

At the last meeting of the Indo-Pacific Fisheries Council (IPFC) considerable attention was given to proposals submitted for the development of an international institute which would be concerned with oceanographic research for the Indo-Pacific region. As a result of these discussions recommendations were made and transmitted from the Director-General of FAO to the Director-General of the United Nations Educational Scientific and Cultural Organization (UNESCO) by whom they were submitted to the last conference of that organization.

The recommendations from the IPFC were considered in the discussion of an agenda item dealing with international research laboratories, which resulted in a resolution calling for a meeting of experts to examine these proposals and to report back to UNESCO, who would then call a meeting of governmental representatives to examine the recommendations. In accordance with this resolution UNESCO, in collaboration with FAO, will convene a meeting of experts in Manila, in the Philippines, 12-13 November 1953. Experts from research institutions, both within and outside the region, have been asked to attend the meeting, which will also be attended by the members of the Executive Committee of the IPFC, which will be meeting in Manila at the same time. The experts will be requested to examine various proposals for the development of the international aspects of oceanographic work for this region.

Indo-Pacific Fisheries Council

The IPFC has accepted the invitation of the Government of Thailand to hold its fifth annual meeting in Bangkok from 22 January to 5 February 1954. A special symposium on plankton will be organized in collaboration with UNESCO.

Emphasis will be placed on the role of plankton in fisheries development. A further symposium, on fisheries marketing and financing, is included in the meeting program.

Among other subjects, the Council will discuss :

1. hydrological programs, including descriptions of analytical procedures and equipment as applied to fisheries ;
2. data concerning the ecology of tuna ;
3. prawn (shrimp) fisheries ;
4. pelagic neritic fisheries ;

5. in the field of fish culture, studies on the optimum densities and compatible associations of species ;
6. information on the seaweed industry.

The Executive Committee will prepare a report on the state of the fisheries industry which will include statistics on fish landings, imports and exports, number of fishermen, craft and gear, and prices of fisheries products ; improvements or recession in specific fisheries and possible causes ; general orientation of government fisheries programs during the past year, including significant changes in administrative procedure, assistance given to fishermen's associations, measures taken for the development of the industry, and future programs contemplated.

Caribbean Fisheries Seminar

The First Caribbean Fisheries Seminar was held 6-7 July 1953 in Port of Spain, Trinidad, under the auspices of the Caribbean Commission. This seminar is the first of an annual series, the outcome of the Caribbean Fisheries Conference, also held in Trinidad, in March, 1952, [*see FAO Fisheries Bulletin*, V. (2), 81-82]. The seminar undertook to review the action taken on the recommendations of the 1952 Fisheries Conference, and recent fisheries developments in the area. Representatives and observers attended from four British, one French, one Netherlands, and one United States dependent territories.

The seminar arrived at a number of conclusions on the recommendations of the Caribbean Fisheries Conference, notably the desirability of listing more comprehensively the fish species occurring in the area ; further legislative action by individual local governments against abuses in fish capture, carrying out socio-economic studies, especially in the causes of the movement of youth away from the industry, and action by governments to remove or abate the duty on certain types of fishing gear.

Various suggestions for developing more fully the resources believed to be available included an extension to other territories, where appropriate, of the methods successfully introduced in Barbados by D.W. Wiles for the capture of flying fish ; the extension of trolling and the use of artificial lures ; the introduction of improved types of fishing craft. Attention was also drawn to the forthcoming conferences on boat design sponsored by FAO. Progress was reported in the culture of fish in fresh water ponds in Jamaica, Trinidad and Puerto Rico.

The possibilities of carrying out a comprehensive sea-going survey of the off-shore fisheries were discussed, and it was felt that the proposal that the Caribbean Commission undertake this should be held in abeyance until some concrete projects for fisheries development emerged in various parts of the region. It was hoped that, in the meantime, participating territories would follow the lead of the French

nd Netherlands governments in supporting the conduct of surveys in ff-shore waters near their respective Caribbean dependencies.

Progress in technological matters was also reviewed, especially n net preservation, local meal-processing industries, small-scale cold torage, and fish smoking.

The governments were reminded that FAO is able, in so far as unds permit, to extend technical assistance in fisheries to Caribbean erritories when so requested ; and attention was drawn to the Organ-zation's proposed training center which it is hoped may be held in 954.

The general usefulness of these annual fisheries seminars was ndorsed, although there was a suggestion that they might be on a iennal basis.

Notes on Publications

FWS 9.2 FISHERIES STATISTICS — U.S.A. UDC 31 : 639.2 (73)

Hile, Ralph ; Lunger, George F. ; and Buettner, Howard J. Fluctuations 1953 in the Fisheries of State of Michigan Waters of Green Bay. *Fishery Bulletin* 75. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A. 34 pp., fig., tables. In English. Price : U.S.$0.25.

Describes statistics of production by fisheries of the State of Michi-gan waters of Green Bay over three periods, 1885, 1891-1908 and 1929-1950. Species breakdown is given and comparisons in this regard between the wo larger series are discussed. Seasonal distribution of the species catch, nd the relations between gear and species catch are also discussed. There s an examination of the fluctuations in abundance of principal species nd of the variations in the intensity of fishing for principal species. Pro-luction in the modern period has not equalled that of the earlier period ut most recent catches show a very great recovery from a severe depression t the beginning of the modern period ; it is shown that this recovery is ased on increased abundance of certain species and on greatly increased ntensity of fishing. Biological, social and economic implications of regu-atory measures for these fisheries are discussed.

FWS 9.11 OCEAN UDC 551.46

Somma, Alberto. Elementi di Meteorologia ed Oceanografia [Elements 1952 of Meteorology and Oceanography]. Part II, Oceanografia. Casa Editrice Dott. Antonio Milani, Padova, Italy. xviii + 758 pp., 322 text, fig., maps, tables. In Italian. Price : Lire 4,500.

Second of two volumes on meteorology and oceanography viewed as he physical part of "Talassografia" and complementary to biological ceanography. This volume deals with the physical and chemical pro-erties of sea water and the methods of observing and measuring them. Distribution of temperature, density and salinity are discussed ; there is n account of bathymetry and of the depths of oceans. Transparency and olor of sea water, the occurrence of ice, wave movements and their meas-rements, and currents, are also discussed.

FWS 9.11 OCEAN UDC 551.46

Sverdrup, H.U. Havlaere [Oceanography]. Fabritius & Sonners Forlag.
1952 Oslo, Norway. 110 pp., 43 fig. In Norwegian. Price : N.Kr.8.

An elementary manual, intended for fishermen, giving a general account of oceanography and its relation to fisheries. The properties of sea water and their distribution are discussed and explained by a series of clear diagrams. The dynamics of water movements are also discussed. The use of echo sounding and other navigational and fish-searching equipment is described.

FWS 9.11 HYDROGRAPHY UDC 551.48

LaFond, E.C. Processing Oceanographic Data. *H. O. Pub.* No. 614.
1951 U.S. Navy Hydrographic Office, Washington, D.C., U.S.A. vi + 114 pp., 27 fig., 20 tables, bibl. In English. Price : U.S.$7.00.

An account of the procedures to be employed in the treatment of oceanographic data and records. The transfer of bathythermograph and other continuous records, from the original recording surface is described, and an account given of the determination of final values of serial temperature and salinity data using appropriate correction methods and tables. The computation of dependent quantities, specific volume and its anomaly, density and sigma-T, and relative currents, is described; the equations, nomograms, and tables for the calculations are presented. Some examples are given of processed serial temperature and salinity data, including horizontal charts and vertical sections. The bulk of the volume is occupied by the tables.

FWS 9.11 HYDROGRAPHY UDC 551.48

United States, Navy Hydrographic Office. Techniques for Forecasting
1951 Wind, Waves and Swell. *H. O. Pub.* No. 604. Washington, D.C., U.S.A. v + 37 pp., 18 fig., 10 pl., bibl. In English. Price : U.S.$1.20.

Gives a brief account of surface waves in water, their description, the empirical knowledge concerning them, their growth and decay. This manual deals with the generation of waves by wind and with the travel of waves in deep water after they have left the regions of strong wind. Methods are described for determining the characteristics of wind waves by means of data from adequate, consecutive synoptic weather maps and for forecasting swell off coasts. Relationships between the waves and the three important variables, *wind* at the sea surface, *fetch*, and *duration*, are discussed.

FWS 6.3 SEAWEEDS UDC 582.26

Dawson, E. Yale. Marine Red Algae of Pacific Mexico. Pt. I. Ban-
1953 giales to Corallinaceae Subf. Corallinoideae. *Allan Hancock Pacific Expeditions*, Vol. 17, No. 1. University of California Press, Los Angeles, California, U.S.A. 239 pp., pl., bibl. In English. Price : U.S.$3.00.

A taxonomic account of the seaweeds of fourteen families, with detailed report of Mexican distribution and keys to their genera and species.

FWS 9.1 MARINE FAUNA UDC 59

Ekman, Sven. Zoogeography of the Sea. *Textbooks of Animal Biology* (Ed. H. Munro Fox). Sidgwick and Jackson Limited, Lon-
1953 don. xiv + 417 pp., 121 text fig., bibl., index. In English. Price : 42s.0d.

This is a second edition in English of the now classical *Tiergeographie des Meeres* originally published in 1935. In making the English edition,

considerable revision has been made and advantage has been taken of recent additions to the literature : a rough examination indicates that the bibliography consists of something more than 25 % of papers and books published since the first edition was written. The framework of the study is constructed from the broad faunal regions of the world, among which the warm water fauna of the shelf holds a major place ; the others are the Mediterranean-Atlantic and the Sarmatic, the Boreal fauna of the North Atlantic, the temperate fauna of the North Pacific, the Arctic, and the regional warm temperate faunas of the Southern Hemisphere. After treatment of these faunas, the author discusses various general questions, including the antiboreal faunal regions and the antarctic, longitudinal distribution and bipolarity, the bottom fauna of the deep sea, the regional distribution and origin of the benthal deep sea fauna, the upper pelagic or epipelagic fauna, and the pelagic fauna of the deep sea.

FWS 9.1 FRESH WATER BIOLOGY UDC 596(268)

Wynne-Edwards, V.C. Freshwater Vertebrates of the Arctic and
1952 Subarctic. *Bulletin* No. 94. Fisheries Research Board of Canada, Ottawa, Canada. 28 pp., bibl. In English. Price : Can.$.0.30.

An analytical study of the fresh water vertebrae of the Arctic and Subarctic. Deals with lampreys, bony fishes, amphibea and mamalia. The bony fishes are : acipenserids, salmonids ; corengonids ; thymallids ; osmerids ; catostomids ; cyprinids ; umbridids ; esocids ; percopsids ; percids ; cottids ; gasterosteids ; gadids.

FWS 9.6 FISHES UDC 597

La Gorce, John Oliver, ed. The Book of Fishes. National Geographic
1952 Society, Washington, D.C., U.S.A. 339 pp., illus., index. In English.

A revised edition of an already familiar work which presents pictures and text concerning the better known food and game fishes and the aquatic life of the coastal and inland waters of the United States. Two hundred and eighty odd species are described and portrayed in color. The photographs, in color and black and white, illustrate many aspects of aquatic life and the industries and sports devoted to fish and other aquatic animals. The text is by various authors, including such well-known names as Leonard P. Schultz, Alan Villiers, Jacques-Yves Cousteau and Hilary B. Moore. The work is quite up-to-date with such special sections as that by Cousteau on the use of the aqualung.

FWS 1.014 FISHES — SPAIN UDC 597(46)

Lozano y Rey, Luis. Los Peces Fluviales de España [Fresh Water Fishes
1952 of Spain]. Ministerio de Agricultura, Dirección General de Coordinación, Crédito y Capacitación Agraria, Madrid, Spain. 251 pp., 20 tables, bibl. In Spanish.

A reference handbook on the ichthyo-fauna of the rivers of Spain. Presents, in addition to a comprehensive, systematic description of the occurring species, a summary of information on the environments in which the fish live, their physiological and biological properties and the fisheries they support.

FWS 1.0114 FISHES — U.S.A. — CALIFORNIA UDC 597(73)

Roedel, Phil M. Common Ocean Fishes of the California Coast.
1953 *Fish Bulletin* No. 91. California Department of Fish and Game, Marine Fisheries Branch, Sacramento, California, U.S.A. 184 pp., 175 fig., bibl. In English.

Gives brief information, under the headings : Relationship, Range, Description, Remarks, Importance, for some 140 odd species representative of

the important families of fish of this coast. The description includes notes on color and size as well as of the important distinguishing features. A short glossary, generalized morphological diagrams, and an illustrated key provide aids for identification. There is a photograph for practically every species.

FWS 1.2 HERRINGS, ETC. UDC 597.5

Ahlstrom, Elbert H. Pilchard Eggs and Larvae and Other Fish
1953 Larvae, Pacific Coast - 1951. *Special Scientific Report: Fisheries* No. 102. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A. 55 pp., tables, bibl. In English. Free.

Consists chiefly of tables of data from 1,437 samples obtained during 12 cruises undertaken by a number of vessels; each cruise consisted of the operation of two, three or four vessels, and the total work actually represents 34 vessel cruises. Methods of sampling, of measurement of volume of water strained during plankton hauls, and of standardization of hauls are described.

FWS 1.1 TUNAS, MACKERELS, ETC. UDC 597.5

Nakamura, Hiroshi. The Tunas and their Fisheries. *Special Scientific*
1952 *Report: Fisheries* No. 82. United States Department of the Interior, Fish and Wildlife Service, Washington, D.C., 25, U.S.A. 115 pp., tables, graphs, bibl. In English.

Deals with spearfishes as well as tunas, for each of which there is a general account of morphology and anatomy, of ecology under which is given: habits, spawning, growth, distribution and migration, and a taxonomic account of several genera. The fisheries for these groups are discussed in respect of their general characteristics, their gear and the use of bait, and the grounds and seasons in respect of currents, depth, topography and other features.

FWS 2.115 BOAT BUILDING UDC 629.12

Ship and Boat Builder Annual Review 1953. John Trundell (Pub-
1953 lishers) Ltd., Temple Chambers, Temple Ave., London, E.C.4. 387 pp., illus., tables. In English. Price: 30s. 0d.

Contains articles on decorative and purposeful applications of plastics, small craft of 1952, light alloy craft on tropical service, selecting the best engine for the job, design for durability, radio navigational aids in small ships, developments in 1952 in equipment for craft and yards, specifications of marine inboard and outboard engines available in Great Britain, terminology of various paints giving manufacturers' specifications and definitions, marine fittings, and yard equipment and material. Also contains directories of boat builders and repair yards in Great Britain and in many other countries, consultants, associations and owners of fish vessels.

FWS 2.5 REFRIGERATED TRANSPORT — BOATS UDC 629.12

Shulters, Earl S. Marine Air Conditioning and Refrigeration. Cor-
1952 nell Maritime Press, Cambridge, Maryland, U.S.A. 357 pp., illus. In English.

This is an enlarged edition of the book *Modern Marine Refrigeration* by the same author (1941), written for use of operating personnel aboard ships. Contains 13 chapters, an appendix and an alphabetical subject index. Air conditioning of living accommodation and cargo holds are discussed. Descriptions of silica gel and Kathabar air dehumidifying plants

are given. Principles of refrigeration, various refrigerants, Freon-12, Freon-11, ammonia and CO_2 are discussed. Also contains certain aspects of marine structural insulation, equipment machinery and piping insulation. Most of the mechanical equipment is described with the aid of schematic diagrams. Each chapter has a list of review questions at the end.

FWS 9.6. FISHERIES INDUSTRIES UDC 639.2

FISHERIES YEAR-BOOK AND DIRECTORY, 1952-53. British-Continental
1952 Trade Press Ltd., 222 Strand, London, W.C.2., 399 pp., illus., tables. In English, with indices in French, Spanish and German, and summaries in French.

Contains articles on the British, Danish and Icelandic fishing industries; a survey of fisheries, fish processing and trade in Algeria, Australia, France, Greece, Greenland, India, Israel, Japan, Malaya, Mexico, Morocco, Netherlands, Norway, Persia, Portugal, South Africa, Spain, Sweden, U.S.A., U.S.S.R. and Yugoslavia; refrigeration progress; smoked salmon trade expansion; smoke curing of fish; world distribution of food fish; International Council for the Exploration of the Sea; fish supply calendar; North American and European trade journals of interest to the fisheries industry; fisheries organizations and trade associations; English fisheries research; the Torry Research Station; a list of fish names in French, German, Norwegian, Danish, Swedish and Dutch, as well as the scientific names; an index of fishing nets; fish oils; the use of measuring and controlling instruments; developments in fishing vessel construction; developments in canning technique. Also contains a trade directory section.

FWS 1 FISHERIES — SWEDEN UDC 639.2(485)

Rosén, Nils. Die schwedische Westküstenfischerei [SWEDISH WEST COAST
1953 FISHERIES]. *Handbuch der Seefischerei Nordeuropas* [HANDBOOK OF THE MARINE FISHERIES OF NORTHERN EUROPE], Vol. VIII, Part 3a. E. Schweizebart'sche Verlag (Erwin Nägele), Stuttgart, Germany. 66 pp., illus., tables, bibl. In German. Price: DM. 26.

An investigation of the fisheries of the west coast of Sweden from the technological, economic and social points of view. Gives details of the technological aspects of the primary production with an extensive account of the grounds, seasons and gear, constituting a documentary survey for the region. Also gives statistical data on landings and an analysis of domestic distribution and industrial utilization of fish. The last chapters give selected information regarding the fishermen, their organization, the fleet, public administration and legislation.

FWS 1 FISHERIES — JAPAN UDC 639.2(52)

FISHERIES ABSTRACTS OF JAPAN, 1950, 1951. Edited and published
1950 by the Committee on Summary of Fisheries Abstracts of Japan. Printed by Printing Office, 7 Kasumicho Azabu, Minato Ku, Tokyo. 1950, 238 pp., text. 23 pp., index; 1951, 351 pp., text, 25 pp., index. In Japanese, with English subtitles.

The two volumes contain a summary review of all important reports, journals and professional lectures on fisheries subjects published in Japan during 1949-50. The fields covered are aquatic animals and plants, fishing and fisheries, processing of marine products, fisheries economy and statistics, etc., with a total of 570 and 1,314 abstracts in the 1950 and 1951 volumes respectively. Japanese and English names of main aquatic plants and animals in Japan are listed in the indices.

FWS 1.016 FISHERIES — NYASALAND UDC 639.2(689)

Lowe, Rosemary H. Report on the *Tilapia* and other Fish and
1952 Fisheries of Lake Nyasa 1945-47. *Fishery Publications* (U.K. Colonial Office), Vol. 1, No. 2, 1952. Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2. 126 pp., illus. tables, bibl. In English. Price : 40s.0d.

A monographic study of the biology and the economics of *Tilapia*, *Labeo* and other species exploited by the fisheries of Lake Nyasa. The greater part of the work is devoted to *Tilapia* and their fishery. The systematics of *Tilapia* are discussed and an account is given of work on studying the growth of species in this group. Their life histories and habits are reported with special reference to breeding habits. The effect of fishing on *Tilapia* is examined and suggestions are offered on possible remedies for the situation which is developing. Similar, but briefer, treatment is given to the other species and the final section deals with the general control and development of the industry.

FWS 1.9 FISH CULTURE — BASSES UDC 639.31

Ball, Robert C., and Tait, Howard D. Production of Bass and
1953 Bluegills in Michigan Ponds. *Technical Bulletin* 231. Michigan State College, Agricultural Experiment Station, Department of Zoology, East Lansing, Michigan, U.S.A. 23 pp., illus., bibl. In English.

Gives an account of the culture of bass (*Micropterus salmoides*) and of bluegills (*Lepomis machrochirus*) in ponds in Michigan. Data are given on the growth of fish in these waters and of the production from the ponds. Various experimental conditions were established especially in relation to the ratio of forage fish to carnivorous fish. The effect of vegetation in the ponds on the survival of bluegills is discussed together with the effect of fertilizer on the higher aquatic plants, and valuation of fertilization of the ponds is offered.

FWS 6.3 SEAWEEDS UDC 639.64

First International Seaweed Symposium. Proceedings. Institute of
1953 Seaweed Research, Inveresk, Midlothian, Scotland. viii + 131 pp., illus., tables. In English. Price : 10s. 6d.

Presents abstracts of papers and summaries of discussions at the Symposium which was held in Edinburgh 14-17 July 1952. Papers were received in five divisions : Phycology (23 papers), Algal Chemistry (19 papers) Utilization (10 papers), Seaweed Harvesting Technology (1 paper), World Seaweed Resources (22 papers). The 75 papers come from a large and representative part of the world. The last group (on resources) relates to 21 countries and gives a useful survey of these resources.

STABILIMENTO TIPOGRAFICO FAUSTO FAILLI - ROMA